10-2014

Effect of Air Carrier Restructuring Strategies on Post-bankruptcy Performance

Harold Dale Townsend
Embry-Riddle Aeronautical University - Worldwide

Effect of Air Carrier Restructuring Strategies on Post-bankruptcy Performance

by

Harold Dale Townsend

A Dissertation Submitted to the College of Aviation
in Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy in Aviation

Embry-Riddle Aeronautical University
Daytona Beach, Florida
October 2014

Effect of Air Carrier Restructuring Strategies on Post-bankruptcy Performance

by

Harold Dale Townsend

This Dissertation was prepared under the direction of the candidate's Dissertation Committee Chair, Dr. Alan J. Stolzer, Professor, Daytona Beach Campus; and Dissertation Committee Members Dr. Dothang Truong, Professor, Daytona Beach Campus; Dr. Thomas Tacker, Professor, Daytona Beach Campus; Dr. Norbert Zarb, Professor, Daytona Beach Campus; and Dr. Neil Seitz, External Member, and has been approved by the Dissertation Committee. It was submitted to the College of Aviation in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Aviation

Dissertation Committee:

Alan J. Stolzer
Alan J. Stolzer, Ph.D.
Committee Chair

Dothang Truong
Dothang Truong, Ph.D.
Committee Member

Thomas Tacker, Ph.D.
Committee Member

Norbert J Zarb
Norbert Zarb, Ph.D.
Committee Member

Neil Seitz
Neil Seitz, Ph.D.
Committee Member

Alan J. Stolzer
Alan J. Stolzer, Ph.D.
Department Chair, Doctoral Studies

Tim Brady, Ph.D.
Dean, College of Aviation

Michael P. Hickey
Michael P. Hickey, Ph.D.
Dean for Research and Graduate Studies

10-15-2014
Date

ABSTRACT

Researcher: Harold Dale Townsend

Title: Effect of Air Carrier Restructuring Strategies on Post-bankruptcy Performance

Institution: Embry-Riddle Aeronautical University

Degree: Doctor of Philosophy in Aviation

Year: 2014

Air carrier bankruptcy is a common occurrence in the aviation industry. However, there is a paucity of research on the topic of air carrier restructuring during the post-bankruptcy period. General restructuring literature has identified four types of actions: operational, financial, managerial, and portfolio. The purpose of this study was to partially fill the large literature gap in the area of air carrier post-bankruptcy performance through theoretical and practical contributions.

A multilevel exploratory factor analysis was conducted to explore whether the same restructuring areas were found in air carrier specific metrics. All four restructuring areas were found in the factor analysis. Next, multilevel modeling was conducted to determine whether each restructuring action had a significant impact on post-bankruptcy performance. The dependent variable used for analysis was the P-Score, an air carrier distress measure. Independent variables were air carrier specific, derived from literature to measure restructuring strategies. The restructuring period was defined as the quarter of bankruptcy filing until three years after emerging from bankruptcy protection. U.S. Department of Transportation financial and operational data from the total population of 25 large air carriers that have emerged from bankruptcy protection was used for analysis.

Operational, financial, and portfolio restructuring were found to have a significant impact on post-bankruptcy performance during the post-bankruptcy period. Managerial restructuring was not found to be significant during the post-bankruptcy period. Additional research of managerial restructuring is needed to better understand this strategy among distressed air carriers. To improve air carrier performance during bankruptcy and restructuring, management should attempt to reduce the cost of transport, consider deleveraging, and acquire debtor-in-possession financing.

This study has contributed theoretically and practically to air carrier restructuring theory. This is the first study to explore air carrier specific restructuring metrics for underlying factors and the first to measure restructuring strategies in all large air carriers that have emerged from Chapter 11 bankruptcy. Additionally, this study is the first to apply multilevel modeling to bankruptcy restructuring research.

DEDICATION

I dedicate this work to my wife. With her, I am everything.

ACKNOWLEDGEMENTS

I would like to express my gratitude to those who assisted me with this dissertation. Without their support and feedback, this journey would not have been possible. My committee chair, Dr. Alan Stolzer, was more help and encouragement than he knows. His immediate response and feedback over the past two years was invaluable and I will be forever grateful. To my committee members and advisors, Dr. Dothang Truong, Dr. Thomas Tacker, Dr. Norbert Zarb, Dr. Neil Seitz and Dr. Irwin Price, thank you for your time and effort guiding me toward this finished work.

I also want to express my thankfulness and love to my family. To my wife, whose support makes everything possible. To my children, who make life exciting. To my parents, who taught me the value of hard work.

TABLE OF CONTENTS

LIST OF TABLES

Page

Table

LIST OF FIGURES

Page

Figure

CHAPTER I

INTRODUCTION

At his 2013 shareholder meeting, investor Warren Buffett described the airline industry as being labor-intensive, capital-intensive with high fixed costs that has "…been a death trap for investors since Orville took off" (Q & A period). The U.S. airline industry's average of six bankruptcies per year since 1978 is indicative of the death trap Warren Buffett refers to (Figure 1). Air carrier bankruptcy is often a last resort for a failing airline and, for some, results in liquidation of the firm.

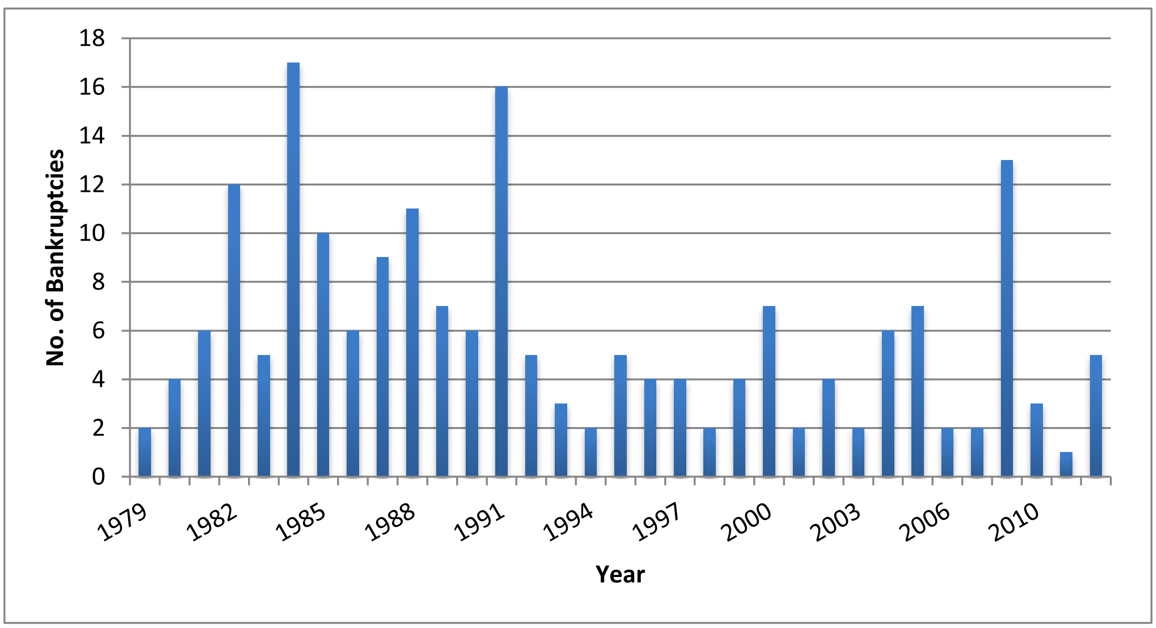


Figure 1. Number of Airline bankruptcies. Chapter 7 and Chapter 11 bankruptcies since 1978.

The Chapter 11 bankruptcy process is an opportunity for an air carrier to restructure and emerge as a successful firm. However, emerging from bankruptcy is not a guarantee of a successful future. Since the Airline Deregulation Act was passed in

1978, four airlines, Braniff, Continental, U.S. Airways, and Trans World Airways have each filed for bankruptcy twice (Airlines for America, 2013). To improve performance during the post-bankruptcy period, it is imperative that bankrupt airlines have a strong and effective plan for restructuring to maximize profit and minimize the impact on stakeholders.

Many stakeholders, including air travelers, can be affected with one air carrier declaring bankruptcy, the four largest U.S. air carriers (Delta Air Lines, American Airlines, United Airlines, and Southwest Airlines) transport 70% of the U.S. market share as measured by revenue passenger miles (RPM). Of these four, only Southwest Airlines has not been through the bankruptcy process. Air carrier bankruptcy is not uncommon in the industry and, thus, warrants a thorough understanding of effective restructuring strategies to improve the future of emerging air carriers.

The study of airline pre-bankruptcy conditions and accurate methods of predicting air carrier bankruptcy has been well researched; some of the models developed are: Altman Z Score model, Altman ZETA model, AIRSCORE model, Pilarski model, Neural Networks, Genetic Algorithms, Gudmundsson model, and "Fuzzy" Logic models (Gritta, Adrangi, Davalos, & Bright, 2008). These quantitative models have been derived using financial and non-financial information to measure the condition of an airline. While literature has thoroughly addressed pre-bankruptcy performance, the area of air carrier post-bankruptcy performance has been mostly ignored.

Air carrier reorganization and turnaround research is sparse and, the three existing studies are each presented as a case study (Lawton, Rajwani & O'Kane, 2011) (Sipika & Smith, 1993) (Bethune & Huler, 1998). Lawton, Rajwani and O'Kane, (2011) studied six non-U.S. air carriers, Sipika and Smith (1993) reviewed Pan American World Airways, and Bethune and Huler (1998) recounted the turnaround of Continental Airlines. A common finding among studies was the need for profit maximization and cost control. Other strategies identified included managerial replacement, staff and culture improvement, product quality enhancement, and strategic alliances or consolidation. While case studies provide an in-depth analysis of the specific air carriers, no large sample studies have been conducted to find relationships between strategy and performance among all restructuring air carriers.

Unfortunately, existing non-air carrier turnaround literature has numerous inconsistencies and is empirically inconclusive. In 2000, Pandit summarized the state of turnaround research, “Despite the frequent incidence of corporate turnaround and over two decades of research effort, our understanding of the phenomenon is very incomplete” (p.1). Ten years later, Eichner (2010) reached the same conclusion that research on turnaround strategies for overcoming financial distress remained weak.

An example of the inconsistency is shown in the adoption of managerial restructuring, where the chief executive officer (CEO) is replaced. Sudarsanamam and Lai (2001) and Smith and Graves (2005) find no support for replacing upper management during restructuring, while Hotchkiss (1995) found that retaining pre-bankruptcy management was strongly related to worse post-bankruptcy performance.

To improve air carrier turnaround literature, this study will examine the four restructuring areas of operational, managerial, financial, and portfolio/asset as proposed by Sudarsanamam and Lai (2001). These strategies have been applied to distressed firms (Eichner, 2010) and to bankrupt firms (Naujoks, 2012). The implementation of these strategies will be measured in large air carriers during the reorganization period of three years after emerging from Chapter 11 bankruptcy.

The impact of these restructuring strategies will be measured by air carrier performance. Performance is measured by an air carrier specific stress indicator called Pilarksi's P-Score. Pilarski and Dinh (1999) developed the econometric model by including the best predictors from financial ratios and specific air carrier variables. The P-Score is the probability of bankruptcy; the higher the P value, the greater the financial stress and chance of failure. The P-Score is the logarithmic function of W, a combined value of asset productivity, capital adequacy, leverage, liquidity, and profitability. The value W will be used as the dependent variable for this study as it is more easily interpreted for analysis, comparability, and is less skewed than P-Score.

Statement of the Problem

The problem in the air carrier industry is best summarized by the U.S. Government Accountability Office (GAO) (2005):

> Bankruptcy is endemic to the airline industry, owing to long-standing structural challenges and weak financial performance in the industry. Structurally, the industry is characterized by high fixed costs, cyclical demand for its services, and intense competition. Consequently, since deregulation in 1978, there have been 162 airline bankruptcy filings, 22 of them in the last five years. Airlines have used bankruptcy in response to liquidity pressures and as a means to restructure their costs. Our analysis of major airline bankruptcies shows mixed results in being able to significantly reduce costs—most but not all airlines were able to do

> so. However, bankruptcy is not a panacea for airlines. Few have emerged from bankruptcy and are still operating. (p. 1)

This high frequency of air carrier bankruptcy and the unsuccessful restructuring of air carriers demand further research. However, literature provides no specific air carrier guidance for restructuring. No study has analyzed restructuring airlines to determine how bankrupt air carriers recovered and whether generic restructuring strategies apply. Air carrier bankruptcy remains an issue that requires further analysis.

Purpose Statement

The purpose of this study is to measure the effectiveness and impact of operational, managerial, financial, and portfolio restructuring strategies on post-bankruptcy performance of air carriers emerging from Chapter 11 by answering the following question:

> How does the implementation of the operational, managerial, financial, and portfolio, restructuring strategies improve air carrier post-bankruptcy performance during the restructuring period?

Significance of the Study

This study will contribute theoretically and practically to air carrier restructuring theory. Theoretical contributions include being the first study to explore air carrier specific restructuring metrics for underlying factors. Additionally, this study is the first to measure restructuring strategies in all large air carriers that have emerged from

Chapter 11 bankruptcy. Results from this study may also further understanding of the inconsistencies found in non-air carrier studies.

Practical contributions of this study include providing stakeholders, owners, debt holders, and management of a bankrupt air carrier guidance for restructuring. The GAO (2005) reported that bankruptcy is not a panacea for airlines as few have emerged and are still operating. Practical value is created when a bankrupt air carrier's management can see the effects of air carrier-restructuring actions in previous bankruptcies and apply these lessons from the past. This study will help fill the large literature gap in the area of air carrier post-bankruptcy performance through theoretical and practical contributions.

Research Questions

Four research questions will be investigated to better understand the contribution of operational, financial, managerial, and portfolio restructuring to post-bankruptcy performance.

RQ1: What is the relationship between operational restructuring on post-bankruptcy performance during the post-bankruptcy period?

RQ2: What is the relationship between financial restructuring on post-bankruptcy performance during the post-bankruptcy period?

RQ3: What is the relationship between managerial restructuring on post-bankruptcy performance during the post-bankruptcy period?

RQ4: What is the relationship between portfolio restructuring on post-bankruptcy performance during the post-bankruptcy period?

Delimitations

This study will focus specifically on large U.S. air carriers emerging from Chapter 11 bankruptcy. U.S. air carriers are selected to limit variability associated with international differences in financial reporting and classification of bankruptcy.

Large U.S. air carriers are defined by the U.S. Department of Transportation (2013) as operating aircraft over 60 seats or with a payload greater than 18,000 pounds; these are selected due to their required quarterly reporting of financial and operational results. Additionally, large air carriers are more likely to have news coverage of restructuring activities.

Data for this study were collected during the period of 1979 to 2012. Limiting data collection post-1978 insures that air carriers are compared in the same deregulated environment. Prior to deregulation, air carrier bankruptcy was rare (Airlines for America, 2013). Deregulation lifted restraints on entry into the industry, pricing, and route structure (Heuer & Vogel, 1991).

Limitations and Assumptions

The most limiting factor in this study is the lack of data. While many air carriers have declared Chapter 11 bankruptcy, only 25 large air carriers have emerged. Most of the recent bankruptcies (e.g., American Airlines) are not included due to lack of post-bankruptcy data as they have not emerged from bankruptcy protection or have very recently emerged. To maximize the number of air carriers available for analysis, a large time period is used (1979 – 2012). While only 25 large air carriers are used for analysis, this encompasses the entire population.

This study also assumes that it is appropriate to combine data for both passenger carriers and cargo carriers. All metrics selected are appropriate for measuring both types of air carriers. A further factor that is not separately analyzed is whether the air carrier was initially a legacy air carrier, existing prior to deregulation, or a new startup. With more data, these distinctions could be explored.

Definitions of Terms

Chapter 7	Bankruptcy where assets are liquidated and claimants are paid based on a hierarchical order. Once all debt holders are repaid, any remaining funds are returned to the owners/shareholders (Altman & Hotchkiss, 2006).
Chapter 11	Bankruptcy where the failed firm has an opportunity to restructure operations, capital, management, business segments, or other areas of the company while being protected from creditors (Altman & Hotchkiss, 2006).
Insolvency	Exists when a business is unable to cover its current debt indicating a lack of liquidity (Altman & Hotchkiss, 2006).
Form 41 Report	The schedule of forms submitted monthly, quarterly, semiannually, and annually to the U.S. Bureau of Transportation Statistics (BTS) by each large certificated

	air carrier subject to the Federal Aviation Act of 1958 (U.S. Department of Transportation, 2013).
Large air carrier	An air carrier holding a certificate issued under 49 U.S.C.41102, as amended, that: (1) Operates aircraft designed to have a maximum passenger capacity of more than 60 seats or a maximum payload capacity of more than 18,000 pounds; or (2) conducts operations where one or both terminals of a flight stage are outside the 50 states of the United States, the District of Columbia, the Commonwealth of Puerto Rico and the U.S. Virgin Islands (U.S. Department of Transportation, 2013).
Major air carrier	Annual revenue greater than $1 billion (U.S. Department of Transportation, 2013).
National air carrier	Annual revenue between $100 million and $1 billion (U.S. Department of Transportation, 2013).
Post-bankruptcy	The period after emerging from bankruptcy protection. For this study, the post-bankruptcy period is three years from emergence.
Regional air carrier	Annual revenue less than $100 million (U.S. Department of Transportation, 2013).
Restructuring	Refers to the operational, financial, managerial, or portfolio actions taken during the turnaround process.

Turnaround	Refers to the process of returning a distressed firm to profitability through the implementation of restructuring actions.

List of Acronyms

AAC	Available ton miles flown per aircraft
AIC	Akaike Information Criterion
ANOVA	Analysis of variance
ASM	Available seat mile
ASTS	Total assets
ATM	Available ton mile
BIC	Bayesian Information Criterion
BTS	U.S. Bureau of Transportation Statistics
CASM	Cost per available seat mile
CATM	Cost per available ton mile
CAPEX	Capital expenditure
CEO	Chief executive officer
DFTE	Departures per full-time equivalent
DIP	Debtor in possession
DIPC	Amount of debtor in possession financing
DOT	U.S. Department of Transportation
EBITD	Earnings before interest, taxes, and depreciation
EBITDA	Earnings before interest, taxes, depreciation, and amortization
FLET	Fleet count

FTE	Full-time equivalent
GAO	U.S. Government Accountability Office
HAC	Hours flown per aircraft
ICC	Interclass correlations
LF	Load factor
MACFT	Miles flown per aircraft
MEFA	Multilevel exploratory factor analysis
MFA	Multilevel factor analysis
MFTE	Miles flown per full-time equivalent
MLM	Multilevel modeling
MSE	Mean Squared Error
OPEC	Of petroleum exporting countries
RASM	Revenue per available seat mile
RATM	Revenue per available ton mile
RITA	Research and Innovative Technology Administration
RPM	Revenue passenger mile
RQ	Research question
RTM	Revenue ton mile
SARS	Severe acute respiratory syndrome
SEC	U.S. Security Exchange Commission
U.S.	United States of America
WC	Working capital
WSCR	Dependent variable W-Score

CHAPTER II

REVIEW OF THE RELEVANT LITERATURE

Air Carrier Bankruptcy History

During the regulated airline environment prior to 1978, airline bankruptcies were very rare (Airlines for America, 2013). In 1978, President Carter signed the Airline Deregulation Act deregulating the industry. Deregulation only lifted restraints on entry into the industry, pricing, and route structure; the airline industry remains heavily regulated in other areas (Heuer & Vogel, 1991).

> The overriding theme of the act was competition. There was to be maximum reliance on competition to attain the objectives of efficiency, innovation, low prices, and price and service options while still providing the needed air transportation system. Competitive market forces and actual and potential competition were to encourage efficient and well-managed carriers to earn adequate profits and to attract capital. (Wensveen, 2011, p.72)

In 1979 and 1980 air carrier bankruptcies were attributed to the OPEC oil embargo, economic recession, high interest rates, and air traffic controller strike, handicapping the industry (Heuer & Vogel, 1991). Inefficient air carriers struggled when regulation protecting them from competition was removed. Defending deregulation, the Southwest Airlines CEO said the problems among airlines were caused by factors unseen to Congress – high interest rates, high fuel prices, and highly leveraged airlines with rising costs (Heuer & Vogel, 1991).

"Where deregulation has failed, bankruptcy has adequately filled the gap" (Heuer & Vogel, 1991, p. 14). Bankruptcy has kept some airlines flying, sold off assets of others that failed, and balanced the interests of all parties (Heuer & Vogel, 1991). Deregulation has given airline management the latitude to make errors and the opportunity to operate without price and route limitations (Heuer & Vogel, 1991).

Air Carrier Bankruptcy

The air carrier industry today remains challenging. To remain solvent, air carriers must maintain a consistent cash flow to support highly leveraged balance sheets while relying on volatile revenue streams from cyclical demand (Pilarski & Dinh, 1999). The U.S. Government Accountability Office (GAO) (2005) attributes the harsh air carrier industry environment to high fixed costs, cyclical demand for services, intense competition, and vulnerability to external shocks. Powerful labor unions have also been successful at pushing U.S. airline employee compensation to twice the average for all U.S. industries (Ben-Yosef, 2005).

The dismal financial performance of air carriers has been explained as a disequilibrium problem known as an *empty core* (Tacker, 2009; Telser, 1994; Bittlingmayer, 1990; Button, 1996; Antoniou, 1998; Nyshadham & Raghavan, 2001). The empty core situation results from the inability to divide production and demand in an oligopoly.

> To illustrate an empty core in simplest terms, suppose that a given industry's cost structure and demand are such that if there are two firms in the industry they will earn above normal profits but that entry by a third firm will result in profits below normal. Thus, normal long run equilibrium is unattainable while short run outcomes are unpredictable. One possible result is perpetual losses if competition

> for the field routinely results in too many firms in the field. However, this situation can also lead to perpetual undersupply, even zero supply if firms eventually abandon an industry prone to horrendous losses. (Tacker, 2009, p. 71)

The most recent major air carrier bankruptcy filed in November 2011 was American Airlines. According to Standard & Poor's (Corridore, 2013) this was an attempt to preserve cash balances after the airline was unable to negotiate labor concessions with unions by strategically protecting cash from pilot retirements, losses, and debt repayments (Corridore, 2013). While other airlines had recently reduced costs through reorganization, American Airlines was unable to reduce costs enough to remain competitive. American Airlines was preceded by Delta and Northwest Airlines which each had large cash balances prior to their own Chapter 11 bankruptcy filings (Corridore, 2013).

Upon filing for bankruptcy, American Airlines announced the replacement of the CEO and has since negotiated a merger with US Airways that will make it the largest airline worldwide (Corridore, 2013). Once the American Airlines merger is complete, it will reduce the number of major airlines in the United States to four: American (merged with US Airways), United (merged with Continental in 2011), Delta (merged with Northwest in 2008), and Southwest (merged with AirTran in 2011).

The recent consolidation of airlines is reducing the oversupply of air travel to a more sustainable and stable level. Airline strategy is shifting from market share gains to sustained profitability (Corridore, 2013). After suffering years of losses, airlines may be focusing on capacity control and airfare pricing to generate sustainable profitability rather than maintaining market share (Corridore, 2013). This shift toward profitability may strengthen the financial condition of air carriers in the future.

Air Carrier Bankruptcy Process. The purpose of bankruptcy is to: (a) protect the contractual rights of stakeholders, (b) liquate unproductive assets, and (c) provide an atmosphere where the debtor can restructure and emerge as a going concern (Altman & Hotchkiss, 2006). The decision to liquidate or reorganize is based on the value of the firm; if the intrinsic value of the firm is greater than the liquidation value, the company should be reorganized; otherwise, the firm should be liquidated (Altman & Hotchkiss, 2006).

The GAO (2005) cautioned that bankruptcy is not a panacea for air carriers; few air carriers have emerged that are still operating. Air carrier bankruptcies are different from other industries because they last longer and are more likely to end in liquidation (U.S. Government Accountability Office, 2005).

Dowdel (2006) argues that Chapter 11 is a competitive strategy for air carriers at the expense of competitors, employees, retirees, and other stakeholders. Instead of using bankruptcy to cut costs of unnecessary layers of management or streamline operations, bankrupt air carriers prolong their protection in bankruptcy court. Some airlines justify bankruptcy because competitors are already operating under bankruptcy protection, and there is no other way to effectively compete (Dowdel, 2006). Dowdell (2006) refers to Northwest Airlines' filing for bankruptcy as a competitive strategy because it had $1 billion in cash and current assets. Dowdel (2006) also found that airlines in bankruptcy protection reduce fares and expand routes once the debt burden has been lifted.

Contradictory to Dowdel's (2006) results, Ciliberto and Schenone (2012) analyzed airline product and market response during bankruptcy and found that carriers reduce routes (by 25%), reduce markets (by 26%), reduce flight frequency (by 21%), and reduce fare price (by 3.1%). After emerging from bankruptcy, they found that only fare price increased (5%) over the pre-bankruptcy metrics. Chapter 11 allows airlines to adjust capacity without incurring major costs from contract violations with gate leases, hangars, and aircraft. While in bankruptcy, airlines can implement strategies that are illegal outside of court protection (Ciliberto and Schenone, 2012). A carrier can default on aircraft leases, and after a 60 day grace period, the lessor then repossesses the aircraft but usually renegotiates payments rather than find a new lessor. The carrier can selectively default on leases of older aircraft with the intent of reducing the aircraft fleet age. Ciliberto and Schenone (2012) found the average age of the fleet decreases 9% while in bankruptcy as the new, more comfortable, higher quality, and more efficient aircraft remain.

Phillips and Sertsios (2011) find that bankrupt air carriers increase product quality above pre-bankruptcy levels in an attempt to retain customers and invest in the reputation of the air carrier. In similar research, the quality of airline service increases during bankruptcy as canceled flights decrease by 8% but then returns to pre-bankruptcy levels after emerging (Ciliberto & Schenone, 2012).

Bankruptcy Defined. Financial distress is often associated with a number of terms that are frequently misunderstood. A *business failure* describes a business that voluntarily or involuntarily ceases operations leaving unpaid obligations or is involved in court actions of reorganization (Altman & Hotchkiss, 2006). A business entity may be economically failed but continue to operate and not be classified as a *business failure* if there is a lack of legally enforceable debt (Altman & Hotchkiss, 2006).

Insolvency or *technical insolvency* exists when a business is unable to cover its current debt indicating a lack of liquidity (Altman & Hotchkiss, 2006). This may be a temporary condition where the firm lacks cash to meet current obligations even though assets in total may be greater than total debt. However, *insolvency* can also be more permanent when the overall net worth of the firm is negative; that is, total debt exceeds total assets. The term *deepening insolvency* is a more recent concept where the judicial system allows a firm to continue operating at the expense of the estate (Altman & Hotchkiss, 2006). Such was the case with Eastern Airlines, where the bankruptcy court essentially subsidized operations when the judge allowed the airline to continue operating and, as a result, lost 50% of its value while in bankruptcy before eventually liquidating (Weiss & Wruck, 1996). "The failure of Eastern's Chapter 11 demonstrates the importance of having a bankruptcy process that protects a distressed firm's assets, not simply from a run by creditors, but also from overly optimistic managers and misguided judges" (Weiss & Wruck, 1996, p. 55).

Default indicates a breach of contract between debtor and creditor (Altman & Hotchkiss, 2006). Violations can be a result of missed payment or worsening financial conditions that cause key ratios to fall below levels specified in the loan covenants (Altman & Hotchkiss, 2006). While a default caused by worsening financial ratios usually only results in a renegotiation of contract, a missed loan payment is more severe and could result in stronger penalties (Altman & Hotchkiss, 2006). Frontier Airlines filed for bankruptcy in 2008 due to its credit card processor holding back proceeds from ticket sales (Bowely, 2008). Frontier president and chief executive, Sean Menke, explained:

> Unfortunately, our principal credit card processor, very recently and unexpectedly informed us that, beginning on April 11, it intended to start withholding significant proceeds received from the sale of Frontier tickets, he said. This change in established practices would have represented a material change to our cash forecasts and business plan. Unchecked, it would have put severe restraints on Frontier's liquidity and would have made it impossible for us to continue normal operations. (Bowely, 2008, p. 1)

A firm that continues to operate and renegotiate with creditors after defaulting on a loan due to a missed payment is undertaking *distressed restructuring* (Altman & Hotchkiss, 2006). Negotiations can occur with many creditors, and the firm may avoid formally declaring and filing bankruptcy. The term *bankruptcy* can refer to the previous definition of *insolvency*, where a firm's net worth is negative, or describe the formal declaration of bankruptcy with a federal district court (Altman & Hotchkiss, 2006).

Bankruptcy Reform Act. The Bankruptcy Reform Act of 1978 contains eight chapters: 1 (General Provisions), 3 (Case Administration), 5 (Creditors, the Debtor, and the Estate), 7 (Liquidation), 9 (Adjustment of Municipality Debt), 11 (Reorganization), 13 (Adjustments of Debts of Individuals with Regular Income), 15 (U.S. Trustee Program). Air carriers can file Chapter 7 or 11; this study focuses on air carriers emerging from Chapter 11.

Liquidation under Chapter 7. Liquidation is justified when the assets of the firm sold individually are more valuable than the capitalized value of the firm existing in the marketplace (Altman & Hotchkiss, 2006). Rarely do all creditors receive payment in full during the liquidation process. Claimants are paid based on a hierarchical order and, once all debt holders are repaid, any remaining funds are returned to the owners/shareholders.

Reorganization under Chapter 11. Reorganization is an opportunity for a failed firm to restructure operations, capital, management, business segments, or other areas of the company while being protected from creditors. Once in bankruptcy the debtor must submit a reorganization plan within 120 days; it is the debtor's responsibility to provide burden of proof as to why the firm should not be liquidated (Altman & Hotchkiss, 2006). The average time in bankruptcy for Chapter 11 firms, across all industries, is almost 2 years (Altman & Hotchkiss, 2006).

Chapter 11 cases must be filed in *good faith* (Heuer & Vogel, 1991). If a case is filed in *bad faith* with the sole purpose for modifying or rejecting a collective bargaining agreement with unions, it will not be allowed. However, it is within the debtor's right to reject collective bargaining agreements if it furthers other legitimate bankruptcy objectives (Heuer & Vogel, 1991). One of the most difficult issues in bankruptcy is striking a balance in labor contracts (GAO, 2005). Labor contracts are often modified in legacy air carrier bankruptcies because the air carriers have been so constrained by unaffordable labor costs and union work rules that, without relief, reorganization would not be possible (GAO, 2005).

To save time and reduce costs, a failing firm may renegotiate with creditors and, upon agreement of new terms, file a prepackaged reorganization plan. The main advantage of a prepackaged plan is that the firm has control over formulating its exit strategy from bankruptcy. The disadvantages include paying necessary fees in cash, advertising the firm's problems to the public, and giving creditors time to begin collection efforts prior to the protection afforded under bankruptcy (Altman & Hotchkiss, 2006).

Restructuring Plan. In Chapter 11, public companies do not have to file financial statements to meet SEC requirements, but instead must provide financial information to the court. When submitting a reorganization proposal, it includes a plan of reorganization and a disclosure statement (Michel, Shaked, & McHugh, 1998). Before being approved, the reorganization plan must be accepted by each debtor class. If a debtor does not accept the reorganization plan, the court can force the debtor to accept the plan if the debtor is as well off through reorganization as through liquidation (Hotchkiss, 1993). The debtor's strongest weapon under bankruptcy protection can be to delay filing the reorganization plan as the time value of money will force creditors to capitulate (Weiss & Wruck, 1996). Once the reorganization plan has been accepted, the firm emerges from the protection of Chapter 11 and enters the post-bankruptcy phase.

Post-bankruptcy. The post-bankruptcy period begins as the firm emerges from protection of the bankruptcy court. The length of this period has been defined in various studies as ranging between two and five years (Eichner, 2010). Das and LeClere (2003) found in a study of 194 firms that only 3% required four of more years to recover. A typical time period to measure for post-bankruptcy success has been three years after emerging from bankruptcy (see Naujoks (2012), Denis and Rogers (2007) and Hotchkiss (1995)).

Turnaround Process

The formal declaration of bankruptcy, acceptance of the reorganization plan, and the emergence from bankruptcy are milestones in the turnaround process. However, the actual turnaround process may have begun prior to declaring bankruptcy when the firm initially began to recognize problems. The eventual bankruptcy filing is an indicator of the severity of the situation. Turnaround strategies may be initiated, and the firm could recover without entering bankruptcy.

Existing turnaround literature proposes a number of strategies for saving failing firms. Arogyaswamy, Barker, and Yasai-Ardekani (1995) proposed that the turnaround process consists of two stages. The first stage reverses and halts the firm’s decline while the second stage positions the firm to compete in the future. To successfully recover, management must support both stages.

Restructuring Strategies. Unsuccessful turnarounds lack planning and attention to restructuring strategies (O'Neill, 1986). It is important that the strategy selected be appropriate for the cause of the decline (O'Neill, 1986). Researchers have proposed many strategies in existing turnaround literature as summarized in Tables 1 and 2.

Table 1. *Non-industry Specific Restructuring Strategies in Literature.*

Non-industry Specific	
Literature	Restructuring Strategies/Process
O'Neill, 1986	Management Cutback Growth Restructuring
Hofer, 1980	Revenue increasing Cost reduction Asset reduction
Ofek, 1992	Operational Management changes Organizational strategy and structure Financial debt-restructuring
Robbins and Pearce, 1992	Retrenchment Recovery
Kamel, 2005	Management Optimizing company size Restructuring Growth
Bibeault, 1981	Management change Evaluation Emergency Stabilization Return-to-normal-growth
Lai & Sudarsanam, 1997	Operational restructuring Asset restructuring Managerial restructuring Financial restructuring Combination strategies
Naujoks, 2012	Operational Financial Managerial Portfolio

Table 2. *Air Carrier Specific Restructuring Strategies in Literature.*

Airline Specific		
Case Study	Air Carriers	Strategies
Lawton, Rajwani, & O'Kane, 2011	Aeroflot Russian Airlines Air Canada All Nippon Airways Linea Aeropostal Santiago-Arica Qantas TAM Linhas Aereas Thai Airways International Turkish Airlines	Operating response Leadership renewal Quality of service Profit maximization Staff development Strategic response Alliance networks Regional consolidation
Bethune & Huler, 1998	Continental Airlines	Market Financial Product People
Sipika & Smith, 1993	Pan American World Airways	Defensive phase Contingency planning Communications Coupling and complexity Consolidation phase Cost Control Offensive phase Configuration Culture

Lai and Sudarsanam (1997) classified restructuring strategies into four categories: operational, financial, managerial, and portfolio.

> A firm facing performance decline may choose operational restructuring to improve its efficiency and profitability, asset sales to raise cash to meet its financial commitments to, say, lenders, renegotiate its debt to relieve the immediate burden of financial commitments, issue new equity to finance its operations or reconfigure its business strategy by making strategic disposals of

> businesses or investing in new business. A precondition to firm revival may often be the removal of existing management. These strategies may be grouped broadly into an operational, asset, financial, and managerial restructuring. (Lai and Sudarsanam, 1997, p.197)

The restructuring strategies proposed by other studies (Tables 1 and 2) are similar to these four categories. Eichner (2010) further validated the usage of these strategies and the affect on performance during firm turnarounds. Naujoks (2012) used the basic strategies proposed by Lai and Sudarsanam (1997) for poor performing firms and applied them to bankrupt firms. He sought to understand how effective select restructuring strategies were to post-bankruptcy performance. Building from Lai and Sudarsanam strategies (Table 3), Naujoks (2012) defined each strategy as shown in Table 4.

Table 3. *Restructuring Strategies proposed by Lai and Sudarsanam (1997).*

Strategy	Definition
Operational restructuring	
Operational restructuring	Cost rationalization, layoffs, closures and integration of business units.
Asset restructuring	
Asset sales	Divestment of subsidiaries, management buy-outs, spin-offs, sale-and-leaseback, and other asset sales.
Acquisitions	Full and partial acquisitions of businesses.
Capital expenditure	Internal capital expenditure on fixed assets such as plant and machinery.
Managerial restructuring	
Managerial restructuring	Removal of Chairman or Chief Executive Officer.
Financial restructuring	
Dividend cut or omission	Omission or reduction of dividends from previous year.
Equity issue	Issue of equity for cash.
Debt restructuring	Debt refinancing involving extending, converting, or forgiving of debt and interest.
Combination strategies	
Cash generative actions	Asset sales and cash equity issue.

Note. Adapted from “Corporate Restructuring in Response to Performance Decline: Impact of Ownership, Governance and Lenders”, by Lai and Sudarsanam, 1997, *European Finance Review*, 1(2), p. 197-233.

Table 4. *Restructuring Strategies measured by Naujoks (2012).*

Strategy	Variable	Definition
Operational	Sales increase	Increase in net sales or revenues by at least 10% compared to reference period.
	Cost reduction	Reduction of costs by at least 10% compared to reference period.
	Personnel reduction	Reduction in number of employees by at least 10% compared to reference period.
	CAPEX increase (reduction)	Increase (reduction) in capital expenditures over total assets by at least 10% compared to reference period.
Financial	Leverage reduction	Reduction in leverage ratio by at least 10% compared to reference period.
	Equity Issue	Mentioning of completed issue of new equity in return for cash. Includes private placements and public offerings as well as rights offering for common or preferred stock.
	DIP financing	Mentioning of the provision of debtor-in-possession financing during Chapter 11.
Managerial	Top Executive Change	Mentioning of the initial change in the top executive position of CEO or president.
Portfolio	Acquisition	Mentioning of a closed majority acquisition.
	Divestment	Mentioning of a completed divestment.

Note. Adapted from "Restructuring Strategies and Post-Bankruptcy Performance," by Naujoks, M., 2012, Doctorate, University of Munich.

As revealed in this literature review, there are no large sample quantitative studies specific to air carrier restructuring. This section of the literature search connects generic restructuring strategies with air carrier specific metrics. Restructuring actions during bankruptcy and the post-bankruptcy phases will be classified using the same constructs as

Lai and Sudarsanam (1997), Robbins and Pearce (1992) and Arogyaswamy, Barker, and Yasai-Ardekani (1995), Naujoks, (2012), and Eichner (2010). Table 5 depicts the variables used in research to measure the restructuring actions proposed by Lai and Sudarsanam (1997).

Operational. "Operational restructuring comprises substantial changes to operational resources, organization and processes, as well as policies" (Eichner, 2010, p.53). Operational changes include improvements to efficiency and productivity. These areas will be reviewed to include air carrier specific metrics.

Revenue. Hofer (1980) proposed revenue generation as one of four operating restructuring strategies, and its importance has been shown in a number of studies (Table 5). In the studies presented, revenue is either measured directly from the income statement or counted as an employed strategy when a press announcement of new products occurs.

A revenue and efficiency metric commonly used in air transportation analysis is revenue per available ton mile (RATM) (O'Konner, 2001) and is available from the U.S. Department of Transportation. Revenue per available ton mile is an air carrier metric for the amount of revenue generated per ton mile flown. Measuring the change in RATM is a proxy for revenue increasing strategies. In a study of airline success, McCabe (1998) found that if revenues are not maximized, every other strategy must be accomplished

Table 5. *Restructuring Strategy Metrics from Selected Studies.*

	Hofer (1980)	Robbins & Pearce (1992)	Arogyaswa-my, et al. (1995)	Lai & Sudarsanam (1997)	Eichner (2010)	Naujoks (2012)
Operational						
Revenue increase	✓		✓		✓	✓
Expense decrease (cost retrenchment)	✓	✓	✓	✓		✓
Announcement of product innovation or new products			✓		✓	
Restructuring announcement to include cost reductions					✓	
Announcement of plant closure				✓	✓	
Announcement of personnel layoffs					✓	
Personnel reduction			✓	✓		✓
Increase in revenue per FTE					✓	
Asset productivity measured by sales per assets	✓	✓	✓		✓	
Asset investment measured by CAPEX				✓		✓
Financial						
Debt reduction by measurement of leverage ratio						✓
Announcement of DIP financing						✓
Announcement of debt restructuring				✓	✓	
Total debt			✓		✓	
Announcement of debt-to-equity swap					✓	
Working capital increase					✓	
Announcement of equity issuance				✓		✓
Dividend cut	✓	✓	✓	✓	✓	
Managerial						
Announcement of change of CEO or Chairman	✓	✓	✓	✓	✓	✓
Portfolio						
Announcement of acquisition or divestment				✓	✓	✓

	Hofer (1980)	Robbins & Pearce (1992)	Arogyaswa-my, et al. (1995)	Lai & Sudarsanam (1997)	Eichner (2010)	Naujoks (2012)
Total assets (asset retrenchment)	✓	✓	✓			
Fixed assets (PP&E net)	✓	✓	✓		✓	

very well if an airline is to be successful. RATM will be considered as an air carrier specific variable for a revenue increasing strategy.

Expense. Expense reducing strategies are common to all studies. Most researchers measure expense directly from the income sheet. In addition to measuring expense reduction, Eichner (2010) considered whether a formal restructuring announcement was made that included cost cutting. Eichner (2010) and Lai and Sudarsanam (1997) also considered whether an announcement of plant closure occurred.

The cost for transporting people or goods can be measured by cost per available ton mile (CATM) (O'Konner, 2001). Robbins and Pearce (1992) propose that firms must strongly reduce costs during the turnaround process. In addition to revenue maximization, McCabe (1998) also found that competitive costs are necessary for airline success. CATM will be considered as an air carrier specific variable for a cost decreasing strategy.

Efficiency and Productivity. In the studies presented (Table 5), labor efficiency and asset efficiency metrics were used. Robbins and Pearce (1992) and Arogyaswamy, Barker, and Yasai-Ardekani (1995) found that reducing the number of employees is necessary to increase efficiency. Schefczyk (1993) argues that productivity alone does not reflect overall airline performance, but high operational performance is a key factor in high profitability. The number of employees will be included as a metric similar to Lai and Sudarsanam (1997), Arogyaswamy, Barker, and Yasai-Ardekani (1995), and Naujoks (2012). Investigating whether an announcement of layoffs was made, like Eichner (2010), is unnecessary since it is self evident by measuring employee headcount.

In addition to measuring change in the number of personnel, productivity can be measured by examining the number of available ton miles (ATMs) produced per employee. ATMs are a measure of airline output or product; the more ATMs produced per employee, the more productive and efficient the air carrier. This is similar to Liedtka (1999) who measured total departures and hours flown per employee.

An additional metric commonly used in the air carrier industry is load factor. Load factor, calculated as revenue ton miles divided by available ton miles, is a percentage of the total aircraft capacity carrying revenue. Once an aircraft departs with empty capacity, the product has expired and provides no further revenue for the airline. McCabe (1998) found that managing load factor is one of the factors that airlines must accomplish well to be successful. Load factor is an air carrier specific measure of productivity and efficiency.

Liedtka (1999) measured labor and asset efficiency by calculating ASM per employee, miles per employee, departures per employee, passenger load factor, hours flown per aircraft, and miles flown per aircraft. Gudmundsson (1999) made similar measurements in an international study of airline failure prediction. These additional efficiency and productivity metrics will be included for study.

Capital Expenditures. Capital Expenditures (CAPEX) as opposed to operational expenses are used to acquire or improve productive assets, such as aircraft, that will generate revenue in future periods. CAPEX investment can vary depending on a number of factors including economic outlook or available cash flow. Robbins and Pearce (1992) find CAPEX reduction can be a short-term strategy for improving short-term cash flow. Naujoks (2012), however, found that reducing capital expenditures during Chapter 11 is negatively related to firm success. CAPEX is not an air carrier specific measurement but will be included for study.

Financial. "Financial restructuring comprises significant and intentional changes to a firm's capital structure or financing charges intended to either improve liquidity or to reduce its financial liability burden (Eichner, 2010, p. 54)." Financial strategy metrics include: leverage, equity issuance, dividend reduction, and DIP financing.

Leverage. As discussed above, higher financial leverage can cause a firm to be forced to react early to financial distress and avoid breaking debt covenants; yet, it is high leverage that can cause a firm to become initially distressed. Naujoks (2012) found that reducing the leverage ratio during post-bankruptcy is positively related to firm success. Altman (1978) published that higher equity financing (less leverage) is correlated with a firm becoming solvent. Leverage can be measured by various ratios; for this study, leverage will be calculated as debt to total assets (Kieso, 2007). Some studies track whether an announcement is made of debt restructuring. For this study, such an announcement is unnecessary, as it will be evident through the leverage ratio, total debt, or working capital ratio.

Total debt and working capital are measured directly from the balance sheet. Changes to the total will represent financial restructuring. Working capital, calculated as current assets less current liabilities, is the net amount of a company's liquid resources available to meet financial demands of the operating cycle (Kieso, 2007).

Equity Issuance. Leverage can be reduced by paying off debt or by issuing equity, thus reducing the leverage ratio. Issuing equity by attracting investors can be difficult if a firm is struggling. Naujoks (2012) found that equity investment usually occurs shortly before or after emerging from bankruptcy. Issuing equity is a cash inflow to the firm and could be interpreted as a positive outlook by investors. Eichner (2010) found no substantial relationship between equity issuance and post-bankruptcy success.

Equity issuance will not be included in this study due to lack of applicability. Equity financing includes the sale of stocks or bonds to the public (Wensveen, 2011). In order to attract funds, air carriers must be at least as strong as competing industries (Wensveen, 2011). Equity financing is usually only available to financially strong air carriers and, as such, is very unlikely to be an option for financially stressed carriers in bankruptcy. Wensveen (2011) clarifies further that most air carrier investments are debt financed.

Dividend Cut. While two of the studies presented, Lai and Sudarsanam (1997) and Eichner (2010), track dividend cuts, they will not be included in this study for the same reason as equity issuance. In recent years, dividend payouts to shareholders have been rare because of the cyclical nature of the industry (Vasigh, Taleghani, & Jenkins, 2012). Air carriers entering bankruptcy protection already lack sufficient cash flow and are not likely to have been making dividend payouts. Naujoks (2012) also excluded this metric because it is not applicable.

Debtor-in-possession Financing. The announcement of DIP lending has been shown in studies to incite a positive stock market reaction. Additionally, studies have shown that acquiring DIP financing has a positive correlation with the success of the reorganization (Altman & Hotchkiss, 2006). DIP financing has also been shown to be associated with shorter reorganization periods and time in bankruptcy (Altman & Hotchkiss, 2006). DIP financing is approved when its value is proven to the bankruptcy court (Altman & Hotchkiss, 2006) and can allow a firm to take advantage of opportunities that are not possible due to the inability to attract equity investment or unsecured debt (Johnson & Stulz, 1985). Naujoks (2012) reported a positive relationship between DIP financing and firm success.

In addition to DIP financing, some air carriers have received financing due to the U.S. government providing a loan guarantee. Congress introduced the Air Transportation Safety and System Stabilization Act on September 22, 2001, in an attempt to stabilize and restore confidence in the airline industry after the terrorist attacks of September 11, 2001 (Morrell, 2007). The Act established a board comprised of representatives from the General Accounting Office and Federal Reserve to implement and oversee compensation and loan guarantees (Morrell, 2007). Air carriers that suffered losses as a result of the attacks received compensation; $4.6 billion was paid to 427 carriers (Morrell, 2007).

The board offered guarantees on loans of up to $10 billion. Airlines with approved loans had to abide by strict covenants including a satisfactory debt ratio, fixed charge coverage ratio, and adequate liquidity (Morrell, 2007). A $900 million loan guarantee was made to US Airways as part of the exit financing for its first bankruptcy in 2003 and was continued during the second bankruptcy in 2005 (Smith, 2006). The US Airways loan guarantee was the only one approved as part of exit financing for an air carrier. In the case of US Airways, the loan guarantees is similar to DIP financing as it was approved only after the board judged that US Airways was a going concern before providing the guarantee.

Managerial. "Managerial restructuring comprises intentional changes to the firm's top management (Eichner, 2010, p.53)." The result of executive replacement is not conclusive. Sudarsanamam & Lai (2001) and Smith & Graves (2005) find no support for replacing upper management during restructuring while Hotchkiss (1995) found that retaining pre-bankruptcy management was strongly related to worse post-bankruptcy performance.

Hotchkiss (1995) found that the current bankruptcy process is full of inefficiencies because incumbent management retains control and proposes the reorganization plan. In her study, she found that retaining pre-bankruptcy management was strongly related to worse post-bankruptcy performance, and that firms often fail to meet cash flow projection (Hotchkiss, 1995). Management can only be forced to resign by a court trustee in cases of fraud or gross mismanagement (Hotchkiss, 1993). LoPucki (1993) found in a study of large public bankruptcy cases that two patterns were consistent, one being that management is usually replaced. In a study of restructuring strategies, Kamel (2005) found that the most common initial strategy in the turnaround process was finding new top management. Bogan and Sandler's (2012) research concluded that the strongest contributor to post-bankruptcy survival was the replacement of management. Eichner (2010) and Naujoks (2012) measured managerial replacement through review of press filings and company reports. In line with many turnaround studies, this research will also study whether management replacement affects performance.

Portfolio. "Portfolio restructuring comprises any substantial change to the firm's asset portfolio through disposal or purchase of fixed assets or majority investments" (Eichner, 2010, p. 53). During the retrenchment stage, divestments are used to generate cash and eliminate unprofitable business segments (Naujoks, 2012). Robbins and Pearce (1992) and Eichner (2010) find a positive relationship between divestments and turnaround success. However, if a core business is divested during bankruptcy Hotchkiss (1993) found a negative effect on post-bankruptcy success. Ciliberto and Schenone (2010) found that bankrupt airlines permanently downsized their route structure, routes decreased by 25%, and markets decreased by 24%. Lawton, Rajwani, and O'Kane (2011) found in their case study research that Aeroflot, Air Canada, and All Nippon Airlines simplified routes and fleet during the turnaround from poor performance.

Gudmundsson found that airlines operating many types of aircraft were more prone to distress.

Eichner (2012) found an insignificant relationship between business acquisitions and turnaround probability. Yet Sudaarsanam and Lai's (2001) results show that firms recovering successfully focus on investment and acquisitions. Airlines have used the opportunity of bankruptcy to expand their route structure while the automatic stay provision of bankruptcy allows airlines to forgo payment of most current expenses (Dowdell, 2006). Lawton, Rajwani, and O'Kane (2011) reported that during the successful turnarounds of Línea Aeropostal Santiago-Arica and TAM Linhas Aéreas, airline management extended and expanded market share. In the recent bankruptcy of American Airlines, the merge with US Airways was included as a portion of the reorganization strategy (Corridore, 2013).

As in previous studies (Table 5), total assets and fixed assets are measured to capture acquisitions and divestments. Similar to Lawton, Rajwani, and O'Kane (2011), fleet size will be analyzed as an air carrier specific metric to determine whether air carriers reduce the number of aircraft as part of asset restructuring.

Bankruptcy Performance Metrics. The success of the turnaround can be defined by accounting metrics of profitability, relative performance to industry, meeting cash flow projections, stock performance, or whether or not the firm files for bankruptcy again (Hotchkiss, 1993) (Table 6). Bankruptcy turnarounds can be considered successful by a number of additional measures, such as whether or not the reorganization plan was approved, whether the same assets and same core operating business remain (LoPucki & Whitford, 1993), or if the firm reorganizes rather than liquidates (Eckbo, 2008).

Table 6. *Performance Metrics of Selected Studies.*

Researcher	Performance Metric
Naujoks (2012)	Free cash flow
Eichner (2010)	Interest coverage
Jory and Madura (2010)	Stock price performance
Jostarndt and Sautner (2010)	Interest coverage
Lemmon, Ma, and Tashjian (2009)	EBITDA
Jostarndt and Sautner (2008)	Interest coverage
Denis and Rodgers (2007)	Operating income before depreciation scaled by total assets
Kalay, Singhal, and Tashjian (2007)	EBITDA scaled by total assets
Buschmann (2006)	Return on investment
Dawley, Hoffman, and Brockman (2003)	Return on assets
Kahl (2001)	EBITD scaled by assets or sales
Alderson and Betker (1999)	Net cash flows and EBITDA scaled by sales
Eberhart, Altman, and Aggarwal (1999)	Stock price performance
Maksimovic and Philllips (1998)	Plant-level productivity and operating cash flows
Lai and Sudarsanam (1997)	Stock price performance
Hotchkiss and Mooradian (1997)	Operating income
Hotchkiss (1995)	Operating income
Asquith, Gertner, and Scharfstein (1994)	Interest coverage
Ofek (1993)	Stock price performance
Airline Specific	
Goll and Rasheed (2011)	Operating profit per operating revenue, return on assets, profit per RPM
Wang (2009)	Operating profit per operating revenue
Tsikriktsis (2007)	Operating profit per operating revenue
Gittell et al. (2006)	Stock price performance
Goll and Rasheed (2006)	Operating profit per operating revenue
Chen (1994)	Operating profit per operating revenue

Note. Adapted from "Restructuring Strategies and Post-Bankruptcy Performance", by Naujoks, M., 2012, Doctorate, University of Munich.

Airline financial condition has historically been studied by liquidity, leverage, activity/turnover, and profitability ratios (Gritta, Adrangi, Davalos, & Bright, 2008). Researchers have combined these ratios to produce a score to measure financial distress and bankruptcy (Gritta, Adrangi, Davalos, & Bright, 2008). Bankruptcy failure prediction models are used by management to assess and monitor the progress of a turnaround (Gudmundsson, 2002). Gudmundsson (2002) describes further that failure prediction models are used by creditors to assess creditworthiness and by investors to assess the risk of insolvency.

In 1968, Altman published seminal research in the area of bankruptcy forecasting. Using 22 ratios from balance sheet and income statement data, Altman selected five that were most predictive of corporate bankruptcy to create the Altman Z-Score Model. Since Altman's (1968) publication, a number of Altman-like models have been developed (Pilarski & Dinh, 1999) such as the Taffler Z-Score and Pilarski P-Score. Agarwal and Taffler (2007) summarize that Z-Scores generate emotion and the response that they do not work because of a misunderstanding of what they are designed to do. "Strictly speaking, what a Z-Score model asks is does this firm have a financial profile more similar to the failed group of firms from which the model was developed or the solvent set?" (Agarwal & Taffler, 2007).

A number of researchers have used predictive failure models to measure whether firms emerging from bankruptcy have a financial profile similar to failed firms or successful firms. Gudmundsson (2002) mentions that failure prediction models have been used extensively by the financial industry as an early warning for business stress, and management uses these models to assess turnaround performance.

Altman, Kant, and Rattanaruengyot (2009) used the modified Altman Z-Score as a measurement of post-bankruptcy success based on the logic that the model has proven to be credible at predicting corporate distress and may be appropriate for measuring a second bankruptcy filing. Altman et al. (2009) found that the companies filing a second bankruptcy petition had significantly worse Z-Scores after emerging from bankruptcy than companies that remained going concerns. Altman et al. (2009) summarized by stating,

> We believe that a credible corporate distress prediction model can be an important indicator of the future success of firms emerging from bankruptcy and could even be used as an independent technique by the bankruptcy court to assess the future viability of the reorganization plan, which, as the Bankruptcy Code stipulates, should be done. (p. 16)

Gritta, Jurinski, and Reed (n.d.) state that the Altman Z-Score model can be used by an analyst or court judge/witness during bankruptcy to forecast the effect of strategies for reorganizing the distressed entity.

In Altman, Kant, and Rattanaruengyot's (2009) article researching post-Chapter 11 bankruptcy performance, they used the modified Altman's Z"-Score model to track post-bankruptcy performance. They describes Altman's work as extending "the applicability of bankruptcy prediction to a unique assessment of the health of corporate industrial entities as they emerge from the Chapter 11 bankruptcy process and [assess] the likelihood that the debtor will have to file for bankruptcy again…" (Altman et al., 2009, p.2). Altman et al. (2009) justifies selection of the Z-Score model as a post-bankruptcy indicator because it has been "proven to be credible and accepted by academics and practitioners for predicting corporate distress" and it could be "effective in assessing the future health of firms emerging from bankruptcy reorganization, especially if the result you are trying to predict (avoid) is a second filing of bankruptcy" (Altman et al., 2009, p. 10). The results of Altman et al. (2009) showed that firms that experience a second filing of bankruptcy had a significantly worse financial profile as measured by the Z-Score than those firms that emerged and continued in that condition.

Lucarelli (2003) notes that the Altman Z-Score model has also been used by turnaround professionals to measure progress. Additionally, he summarizes that, "following a plan that improves the Z-Score helps validate the turnaround plan by providing management with a tool it can understand, buy into, and follow" (Lucarelli, 2003, p. 10). Altman and La Fleur (1981) describe how the Altman Z-Score was actively used to manage the financial turnaround of GTI Corporation. The management strategy formulated and implemented by Jim La Fleur (Altman & La Fleur, 1981) proposed and implemented strategies which decreased the ratios and caused the Z-Score to decrease, reducing the risk of bankruptcy. The authors concluded that the GTI Corporate turnaround proved how predictive models could be used as management tools for implementing a business turnaround and encouraged managers to review predictive models related to their company's operations. Altman and Hotchkiss (2006) summarize, "In addition to the prescriptive use of a financial model in turnaround strategy, we advocate the Z-Score model's use as a type of barometer to any restructuring" (p.306).

The shortcoming of the Altman Z-Score model for this study is that it is not specific to air carriers. However, an Altman-like model called Pilarski's P-Score is an air carrier specific bankruptcy model created by Pilarski and Dinh (1999). As air carrier specific bankruptcy research is less prominent than combined industry research, so is the use of the P-Score. Pilarski and Dinh (1999) used logistic regression to create the P-Score model for airline financial distress; the probability of bankruptcy is calculated by Equations 1 and 2.

$$W = -1.98X_1 - 4.95X_2 - 1.96X_3 - 0.14X_4 - 2.38X_5 \qquad (1)$$

Where:

X_1 = operating revenues/total assets

X_2 = retained earnings/total assets

X_3 = equity/total debt obligations

X_4 = liquid assets/current maturities of total debt obligations

X_5 = earnings before interest and taxes/operating revenues

The P-Score (P) is determined by Equation 2:

$$P = 1/\left(1+e^{-W}\right) \qquad (2)$$

The P-Score is the probability of bankruptcy; the higher the P value, the greater the financial stress and chance of failure. Goodfriend, Gritta, Adrangi, and Davalos (2004) found through a comparative study that the P-Score and Altman's modified Z"-

Score are correlated. Pilarski and Dinh (1999) developed the econometric model by including the best predictors from financial ratios and specific airline variables. Data for analysis came from air carriers between 1981 and 1997, where Pilarski and Dinh (1999) were able to use 36 bankruptcies for analysis. The P-Score value is logistically distributed so the probabilities will tend toward 1 (bankrupt) or 0 (non-bankrupt). Variables X_1, X_2, and X_3 are the same as Altman's Z-Score, while the remaining two are very similar. The median time from prediction of bankruptcy to the actual event is three and a half quarters (Pilarski & Dinh, 1999). A favorable attribute of the P-Score model is that it includes many operating characteristics of an air carrier: asset productivity, capital adequacy, leverage, liquidity, and profitability (Pilarski & Dinh, 1999).

Summary

This literature review introduced air carrier history, operations during the regulated era, and the effects of deregulation. The air carrier industry is described through the empty core problem, and characteristics of successful and unsuccessful air carriers are presented. A number of studies indicate operational performance is linked to air carrier profitability, and that leverage and profit metrics are crucial indicators of airline health. Next, financial distress and the bankruptcy process are defined to include terms such as debtor-in-possession financing and renegotiation of labor contracts.

The definitions of turnarounds and success metrics are discussed, and restructuring strategy literature is presented that covers non-bankruptcy turnarounds. Often the first step during the turnaround process is retrenchment, where costs are reduced throughout the firm. Most restructuring strategies discovered during cross-industry studies have addressed four areas: operational, financial, managerial, and portfolio/asset restructuring. These restructuring actions are compared to the stakeholder preferences of owners, lenders, and management due to competing interests while a firm is in survival mode.

Bankruptcy turnaround literature is presented along with the few airline reorganization studies. The most specific airline turnaround case study found that profit maximization, service quality, leadership replacement, and staff development are the most critical factors for air carrier reorientation. Chapter 11 bankruptcy is portrayed as a competitive strategy where an airline can renegotiate labor contracts, renegotiate long-term leases, and default on aircraft lease payments to reduce and modernize the fleet. Lastly, restructuring strategies are discussed with air carrier specific metrics.

The proposed research involves a number of literature areas: airline industry, financial distress, airline crisis response, restructuring strategies, reorganization, and post-bankruptcy performance. Airline literature thoroughly addresses pre-bankruptcy and financial distress within the industry, yet lacks relevant research in the areas of restructuring strategies, reorganization, and post-bankruptcy performance. While studies have been conducted on post-bankruptcy topics, they are broad and include many industries.

Through this literature search, the air carrier specific metric, P-Score, was identified as a measurement of air carrier distress. Existing literature also classifies restructuring strategies into four groups: operational, financial, managerial, and asset restructuring. Specific air carrier research also identifies metrics available to measure the implementation of these strategies.

Research Goal

The purpose of this study is to measure the effectiveness of operational, managerial, financial, and portfolio restructuring strategies on air carriers emerging from Chapter 11 by answering the following four research questions:

RQ1: What is the relationship between operational restructuring on post-bankruptcy performance during the post-bankruptcy period?

RQ2: What is the relationship between financial restructuring on post-bankruptcy performance during the post-bankruptcy period?

RQ3: What is the relationship between managerial restructuring on post-bankruptcy performance during the post-bankruptcy period?

RQ4: What is the relationship between portfolio restructuring on post-bankruptcy performance during the post-bankruptcy period?

As discussed in the literature review, most of the turnaround literature is cross-industry with very little specific to the air carrier industry. This study aims to fill the large literature gap in the area of air carrier post-bankruptcy performance by investigating the impact of the four restructuring strategies during bankruptcy and the post-bankruptcy period.

CHAPTER III

METHODOLOGY

Research Approach

This research is a longitudinal study of existing data submitted by air carriers to the U.S. Department of Transportation that have filed Chapter 11 bankruptcy and then emerged from bankruptcy protection. The literature review identified variables to measure each restructuring area. A multilevel factor analysis was conducted to explore underlying factors in air carrier restructuring actions. The air carrier metrics were regressed in a two-level multilevel growth model to investigate the individual differences between air carriers over three years following emergence from bankruptcy.

Pandit (2000) found that although there has been over two decades of restructuring strategy research, literature is very incomplete due to two issues: problems with research design and ad hoc investigation. The issue with ad hoc research is "…that they have either proceeded without a priori theoretical guidance or have failed to relate findings to extant theory ex post" (Pandit, 2000, p. 31). This study avoids both issues by performing quantitative analysis with guidance from prior theory.

Restructuring strategies and post-bankruptcy performance were measured by modifying the theoretical restructuring models of Robbins and Pearce (1992) and Arogyaswamy, Barker, and Yasai-Ardekani (1995) as Naujoks (2012) did for bankruptcy, along with restructuring strategies from Lai and Sudarsanam (1997**)** and Eichner (2012). Pandit (2000) argues that profitability alone is not appropriate for measuring strategy effectiveness because it may lag. To avoid the problem with only measuring profitability, the present study used an airline stress indicator, P-Score, created by Pilarski and Dinh (1999) for measuring air carrier bankruptcy probability.

This research is similar to Eichner (2012) and Naujoks (2012) and builds upon Pettigrew's (1990) recommended model for strategic management research and strategic change. Pettigrew's explanation of strategic change is built upon content, process, and context. Content in the present study were the effects of time and the four restructuring strategies presented by Lai and Sudarsanam (1997): operational, financial, portfolio, and managerial restructuring. Analyzing restructuring strategies occurred during the period from an air carrier declaring bankruptcy until three years after exiting. The context in which this restructuring occurs included both internal and external factors that were controlled for in this study.

Time. This study measured quarterly data for the period when the bankruptcy filing was made, and the next measurement occurred when the air carrier emerged from bankruptcy. Similar to previous literature, quarterly measurements were made for three years after the air carrier emerged from bankruptcy. The post-bankruptcy time period may differ between air carriers if the airline liquidated or merged with another carrier. Measuring time allowed for relationships to be discovered between strategy implementation and performance for each air carrier.

Dependent Variable. The dependent variable used for analysis was the P-Score. Previous studies (Table 6) have used a number of metrics to measure post-bankruptcy performance, such as accounting metrics of profitability, relative performance to industry, meeting cash flow projections, stock performance, and whether or not the firm files for bankruptcy again (Hotchkiss, 1993). For the current study, stock price performance was not considered due to the numerous external factors affecting price, and relative performance to industry was not applicable, as this study sought to measure internal performance after declaring bankruptcy. In some cases, an air carrier emerging from bankruptcy is out performing many air carriers in the industry which enter bankruptcy but never emerge (GAO, 2005). To measure post-bankruptcy performance, a metric that measures specific conditions of an air carrier was necessary.

Pandit (2000) explained that the most complete method to measure a firm's performance is with more than one metric. Pandit (2000) noted that current turnaround research is inadequate when only profitability is used to define success; multiple measurements are more complete. Pandit (2000) explained that the condition of a firm and profitability are not perfectly correlated; the firm's condition can continue to decline while profitability may remain constant and then suddenly decrease substantially. Including measurements in addition to profitability can also provide a more accurate perspective if management is intentionally manipulating earnings.

As described in Chapter II, models have been developed to measure financial stress within a firm. These models, such as Altman's Z-Score and Pilarski's P-Score, measure performance with more than one metric; metrics may include asset productivity, capital adequacy, leverage, liquidity, and profitability (Pilarski & Dinh, 1999). As discussed in the literature review, these types of financial stress models have been used to measure firm performance, pre-bankruptcy and post-bankruptcy. While the Altman Z-

Score model could be used as the dependent variable for the present study, the most appropriate measurement is the air carrier specific metric, Pilarski's P-Score (1999).

The P-Score was appropriate for this study as the dependent variable because it is specific to air carriers with a prediction rate of 85.1%. Additionally, the P-Score is a measure of five characteristics of the air carrier rather than just profitability. The P-Score model has also been used by the U.S. Department of Transportation to track air carrier financial strength (Gritta, Adrangi, Davalos, & Bright, 2008).

In the present study, P-Score is calculated on a quarterly basis for each airline and allowed for comparability between air carriers because it was not affected by accounting differences of owning versus leasing of aircraft. To calculate the P-Score, each variable was weighted to calculate W (*Equation* 1); next, the logarithmic function of W (*Equation* 2) yielded the P-Score. Pilarski and Dinh (1999) transform W for the simplicity of making the P-Score value fall between 0 and 1. In the present study, the W variable is referred to as the W-Score (WSCR), and was used as the dependent variable without transforming the value into the P-Score. By not transforming W, the value is more easily interpreted for analysis comparability, and is less skewed.

Independent variables. The independent variables of this study are listed in Table 7. These air carrier specific variables were generated through the literature search and described in Chapter II. The following section clarifies the calculations of each independent variable. Data used for the financial and operating statistic calculations were retrieved from Form 41 data. The Form 41 reports are described by the U.S. Department

Table 7. *Independent Variables.*

	Air Carrier Specific Metric	Variable	Variable Type	Variable Scale
Operational				
Revenue	RATM	*RATM*	Continuous	Ratio
Expense (cost retrenchment)	CATM	*CATM*	Continuous	Ratio
Personnel	FTE	*FTE*	Continuous	Ratio
Asset investment	CAPEX	*CAPEX*	Continuous	Ratio
	ATM/FTE	*AFTE*	Continuous	Ratio
	Load factor	*LF*	Continuous	Ratio
	Miles/FTE	*MFTE*	Continuous	Ratio
Efficiency and productivity	Departures/FTE	*DFTE*	Continuous	Ratio
	Hours flown/aircraft	*HACFT*	Continuous	Ratio
	Miles/aircraft	*MACFT*	Continuous	Ratio
	ATM/aircraft	*AACFT*	Continuous	Ratio
Financial				
Debt reduction by measurement of leverage ratio	Debt/Equity	*DE*	Continuous	Ratio
Announcement of DIP financing	Press statement	*DIP*	Discrete	Nominal
Amount of DIP financing	Press statement	*DIPC*	Continuous	Ratio
Total debt	Debt	*DEBT*	Continuous	Ratio
Working capital increase	CA less CL	*WC*	Continuous	Ratio
Managerial				
Announcement of change of CEO or Chairman	Press statement	*CEO*	Discrete	Nominal
Portfolio				
Total assets (asset retrenchment)	Assets	*ASTS*	Continuous	Ratio
Fixed assets (PP&E net)	Fleet Size	*FLEET*	Continuous	Ratio
	Non-current assets	*NCA*	Continuous	Ratio

of Transportation Research and Innovative Technology Administration (DOT RITA) (2013) as:

> The statistics collected on the financial forms submitted monthly, quarterly, semiannually, and annually to BTS by each large certificated air carrier subject to the Federal Aviation Act of 1958. The four classes of financial and operating statistics collected on individual schedules of the Form 41 Report are grouped as follows: (A) Certification, (B) Balance Sheet Elements, (P) Profit and Loss Elements, and (T) Traffic and Capacity Elements.

Operational. Revenue per available ton mile (RATM) was calculated by dividing *Operating revenues* by *Available ton miles. Operating revenues* are defined by the U.S. DOT RITA (2013) as:

> Revenues from the performance of air transportation and related incidental services. Includes (1) transport revenue from the carriage of all classes of traffic in scheduled and nonscheduled services, and (2) nontransport revenues consisting of Federal subsidy (where applicable) and revenues for services related to air transportation (Glossary).

Available ton miles are defined as "The aircraft miles flown on each flight stage multiplied by the available capacity on the aircraft in tons." (U.S. DOT RITA, 2013).

Cost per available ton mile (CATM) was calculated by dividing *Operating expense* by *Available ton miles. Operating expenses* are defined as, "Expenses incurred in the performance of air transportation, based on overall operating revenues and overall operating expenses. Does not include nonoperating income and expenses, nonrecurring items, or income tax" (U.S. DOT RITA, 2013, Glossary).

Calculations using the number of employees, *Full-time equivalent employees,* are defined as:

> The number of full-time equivalent employees equals the number of employees on full-time schedules plus the number of employees on part-time schedules converted to a full-time basis. Two part-time employees are counted as one full-time employee. An airline's number of full-time equivalent employees will be less than the number of its total employees unless it has no part-time employees (U.S. DOT RITA, 2013, Glossary).

Monthly full-time equivalent (FTE) data are only available from 1990 to present. Prior to 1990, airlines reported annual headcount data as full-time or part-time employees. For comparative FTE calculations for airlines reporting prior to 1990, part-time employees were considered to equal half of a FTE. Due to lack of monthly or quarterly reporting, prior to 1990, the annual calculated FTE value was also used for the previous three quarters. This method was only necessary for FTE data from Braniff Airways and Continental Airlines first bankruptcy.

Capital expenditures (CAPEX) are reported in financial statements on the cash flow statement. Form 41 submissions only require air carriers to report income statement and balance sheet information. As the cash flow statement is created from the income statement and balance sheet, capital expenditures can be calculated by Equation 3 (Bragg, 2012):

$$CAPEX = NEWPPE - OLDPPE + DEP \tag{3}$$

Where:

CAPEX = Capital Expenditures

NEWPPE = Current period property, plant, and equipment from balance sheet

OLDPPE = Previous period property, plant and equipment from balance sheet

DEP = Depreciation reported in current period from income statement

Load factor was calculated by dividing *revenue ton miles* (RTM) by *available ton miles* (ATM). *Ton miles* are defined as "One ton (2,000 pounds) transported one statue mile. Ton-miles are computed by multiplying the aircraft miles flown on each inter-airport segment by the number of tons carried on that segment" (U.S. DOT RITA, 2013, Glossary). "*Revenue ton-miles* are computed by multiplying the revenue aircraft miles flown on each flight stage by the number of tons transported on that stage" (U.S. ECFR, 2014). Load factor was calculated in this manner to be consistent between passenger carrying air carriers and cargo carrying air carriers. RTM and ATM are reported by the DOT by both passenger and cargo air carriers. Passengers are converted to ton miles by considering each passenger as 200 pounds (U.S. ECFR, 2014).

The remaining efficiency and productivity calculations that required *Miles, Departures,* and *Hours* were found in the Form 41 reports. A revenue *Mile* is defined as: "A statute mile (5,280 feet). All mileage computations are based on statute miles" (U.S. DOT RITA, 2013, Glossary). A revenue *Departure* is defined as "A takeoff made at an airport" (U.S. DOT RITA, 2013, Glossary). A revenue *Hour* is defined as an airborne aircraft hour (U.S. DOT RITA, 2013, Glossary).

The number of aircraft operated by each air carrier is also available from U.S. DOT RITA (2013) in Form 41 data. This information is only available annually after 1992. The reported number of aircraft operated for the year ending was also used for the prior three quarters. Prior to 1992, aircraft fleet information was retrieved from press statements and air carrier published documents.

Financial. The *leverage ratio* was calculated by dividing total debt by total equity. Both values were taken from the balance sheets supplied through Form 41 submissions. *Working capital* was calculated by the Form 41 values of current assets less current liabilities (Kieso, 2007).

Announcement of *DIP financing* was determined by searching the LexisNexis Database for press releases and public financial filings containing the keywords: DIP financing, debtor in possession financing, and bankruptcy financing. The use of DIP financing was coded as a dichotomous variable for multilevel modeling (MLM) where *one* indicates use of DIP financing, and *zero* indicates no DIP financing. The amount of DIP financing was found on the same press releases to create the continuous DIP variable for the exploratory factor analysis.

Managerial. The replacement of the CEO was determined through a combination of air carrier annual reports, air carrier history obtained from the company website, or through a search of the LexisNexis database. The database was searched over the period of bankruptcy and post-bankruptcy for the words CEO or Chief Executive Officer to identify press releases discussing CEO replacement. The replacement of the

CEO was coded as a dichotomous variable where *one* indicates replacement of the CEO during bankruptcy or the subsequent three years, and *zero* indicates no CEO replacement.

Portfolio. Total assets were retrieved from financial statement balance sheets. Non-current assets are calculated by subtracting current assets from total assets. Fleet size information was retrieved as described above in the Operational section.

Control variables. The following control variables considered to normalize airline performance were tested during model creation and included if appropriate: gross domestic product, jet fuel price, number of air carriers operating, and total industry revenue. Due to the cyclical nature of airlines and their dependency on general economic conditions, gross domestic product was tested to control for the external environment, similar to Guzhva and Pagiavlas (2004). Jet fuel was tested as a control due to extreme variability in price. The number of air carriers operating was included to control for competitiveness and total industry revenue was included to account for economic conditions within the air carrier industry.

The control variables selected for testing were included based on being used in previous air carrier studies: Gross domestic product, Lai (1997); Fuel price, Goll & Rasheed (2011); Total industry revenue, Goll & Rasheed (2011), Hotchkiss (1993). While there are many variables that could be considered for analysis, too many variables can over-fit the model (Raudenbush & Bryk, 2002). For parsimony, three control variables were included and tested for predictability along with the independent variables.

Due to methodological constraints, thorough analysis was conducted before any variables were included in the final model.

Multilevel Exploratory Factor Analysis. Exploratory factor analysis was conducted prior to multilevel modeling to further understand whether the four restructuring areas proposed in the literature also describe air carrier restructuring metrics. Factor analysis on the air carrier independent variables may reveal that the four restructuring areas of operational, financial, managerial, and portfolio exist in the air carrier data or there may be other latent factors specific to air carriers. The resulting factors were not used as an input to the multilevel model, but this exploration further adds to air carrier restructuring literature.

Fabrigar, Wegener, MacCallum, and Strahan (1999) suggest including at least four measured variables for each of the expected factors in the data to improve accuracy of the results. As a result of this guidance, *CEO,* the only variable measuring managerial restructuring, was not included in the factor analysis. When reporting results, managerial restructuring was considered a separate restructuring strategy that exists in addition to the factors discovered through the exploratory analysis.

The assumption of normality was also tested for while performing descriptive statistics. Additional guidance from Linda Muthen, co-developer of MPlus statistical software, regarding data in this study was also followed, “You should not do a log transformation of the variables. This changes the correlations among the variables. You should divide them by a constant. This does not change the correlations among the variables” (personal communication, March 31, 2014). To determine how many factors to include in the model, a combination of a scree test, eigenvalues, and descriptive fit indices were reviewed. As suggested by Fabrigar, et al. (1999), oblique rotation was used to perform the factor analysis. Oblique rotation allows for the factors to be correlated while orthogonal assumes no correlation. As suggested by Muthen (2010), when factoring with non-normal data, maximum likelihood estimation is used for the multilevel exploratory factor analysis (MEFA).

The data in the present study has a hierarchical structure because repeated measures are made on each air carrier. An assumption of factor analysis is that observations are independent (Field, 2009). This assumption is not upheld with the data collected in this study. Historically, researchers have dealt with the issue via two approaches (Reise, Ventura, Nuechterlein, & Kim, 2005). Some researchers select one observation at random from each study participant. While this method meets the assumption of independence, it severely reduces the sample size and therefore is not appropriate for the present study. The other option chosen by some researchers is to ignore the hierarchical structure of data and treat all observations as independent (Reise, et al., 2005). While the second approach uses all of the data, the parameter estimated standard errors and model fit statistics may be inaccurate (Reise, et al., 2005).

A more recent method developed for avoiding these problems is multilevel factor analysis (MFA). Initially, MFA was proposed as a four step process by Muthen (1994). These four steps for exploratory factor analysis are:

> First, conduct an ordinary exploratory factor analysis of the total correlation matrix. This “incorrect” analysis is based on treating all the observations as independent. The objective of the first step is to obtain a rough sense of the

> underlying factor structure. The second step is to estimate the ICC (interclass correlation) for each item. This step establishes whether an MFA is necessary. The third and fourth steps, respectively, are to estimate a within-correlations and between correlation matrix and conduct factor analysis for each matrix separately. (Reise, et al., 2005, p. 130)

Factor analysis also assumes that variables are continuous with an interval or ratio scale (Field, 2009). This study has two dichotomous variables, *DIP* and *CEO.* As discussed above, *CEO* was removed for the factor analysis. *DIP* was converted to a continuous variable for the exploratory factor analysis by measuring the amount of DIP financing received by each air carrier. While Field (2009) states that factor analysis can occur with dichotomous variables if the correlation matrix is constructed from tetrachoric correlation coefficients, all variables in this study are continuous to simplify factor analysis results. SPSS 18 (2014) software was used for data preparation and descriptive statistics; Mplus (Muthén & Muthén, 2012) software was chosen for the exploratory MFA because it performs the analysis in a single step.

Selection of Statistical Methodology. The objective of this research is to find any existing relationships between air carrier performance measured by the P-Score and strategies employed after bankruptcy. This research question requires longitudinal regression to link the independent variables, or strategies, to the dependent variable, W-Score.

Multiple regression and ANOVAs are inadequate for addressing this type of research question. According to Raudenbush and Bryk (2002), using multiple regression for analyzing change over time will result in smaller standard errors, but is usually not appropriate because the repeated measurements of individuals violates the assumption of independence of observations. In this study, air carriers were measured quarterly from a period of three years after emerging from bankruptcy making multiple regression improper.

Analysis using ANOVA is also not appropriate because it would require many variables to analyze clusters. Including many variables will reduce power especially since the data set is relatively small. ANOVAs also require that a complete case or cross-section be removed if any data are missing. Additionally, ANOVA is only used for a comparison test and does not test the impact of independent variables on a dependent variable.

As described later regarding sample size, the lack of large air carriers emerging from bankruptcy also limits the statistical methods available. Designing a study where the data are split into successful and unsuccessful air carriers is not appropriate due to the relatively small number of air carriers. As such, multiple discriminate analysis and logistic regression, two common methodologies used in related studies, are not used due to this limitation.

Multilevel modeling is a methodology appropriate for analyzing data that have been measured repeatedly on an individual and, thus, is used in this study. Hierarchical or multilevel models allow for analysis of time-series and cross-sectional data (Tan, 2008). Additional benefits of multilevel models include not adhering to the assumption of homogeneity of regression slopes and not being limited by missing data (Field, 2009).

The ability of MLM to accommodate data that are inappropriate for other statistical methods takes full advantage of all air carrier data available.

Singer and Willett (2003) state that there are three criteria for conducting MLM: (a) three or more waves of data, (b) a method of measuring time, and (c) a method of measuring the dependent variable. The more waves of data measured allow for more statistical models. The fewer the waves of data, the simpler the model has to be, and growth is often assumed to be linear.

Singer and Willett (2003) state that time must be measured reliably and validly so that change can be detected over time. While equally spaced time measurements are appealing, it is not required for MLM. Individuals are not required to be measured on an identical schedule nor must each individual have the same number of waves. In this study, the air carriers are measured on the same schedule, but not all have 13 waves of data. The last criterion states that the dependent variable must change systematically over time, and the validity and precision of the metric must be preserved. This systematic change over time was tested during preliminary analyses. All three criteria are met, allowing for MLM.

Multilevel Research Model

MLM is similar to ordinary least squares regression where an outcome variable is predicted by a linear combination of variables (Osborne, 2008). In this study, there are two levels, the repeated measures of restructuring actions are denoted as first-level observations, and the air carriers are denoted as second-level observations. The multiple observations on each air carrier are viewed as nested within the air carrier (Figure 2).

According to Raudenbush & Bryk (2002), when multiple observations are treated as nested, it allows the researcher to analyze, without difficulty, data where the number and spacing of measurements varies across subjects.

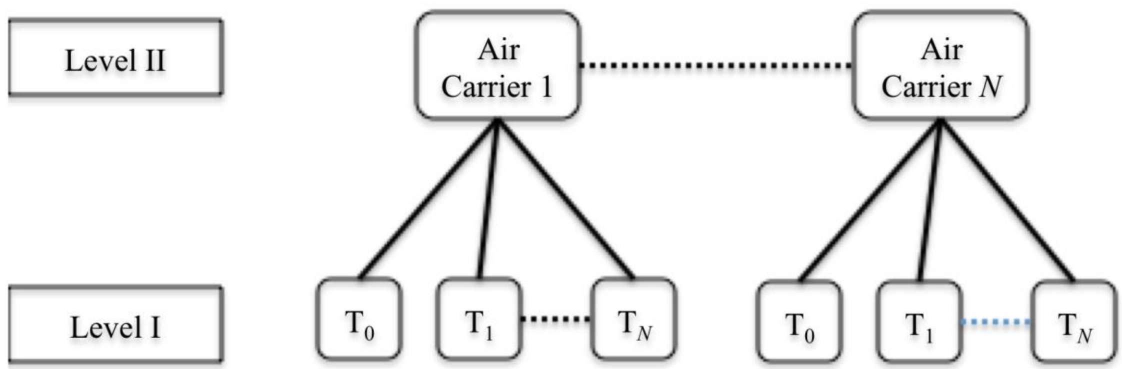


Figure 2. Multilevel structure.

Multilevel modeling was used to answer the research questions. The first level of analysis measures the within-individual change over time (Level – 1 submodel) (Equation 4) and the second level model identifies inter-individual differences in change (Level – 2 submodel) (Equation 5).

$$Y_{ij} = \pi_{0i} + \pi_{1i} X_{ij} + \varepsilon_{ij} \tag{4}$$

Where:

Y_{ij} = dependent variable

π_{0i} = intercept of the true change trajectory for individual *i* in the population

π_{1i} = slope of the true change trajectory for individual *i* in the population

X_{ij} = independent variable

ε_{ij} = random measurement error

i = individual air carrier

j= time period

$$\begin{aligned} \pi_{0i} &= \gamma_{00} + u_{0j} \\ \pi_{1i} &= \gamma_{10} + u_{1j} \end{aligned} \tag{5}$$

Where:

π_{0i} = intercept of the true change trajectory for individual i in the population

π_{1i} = slope of the true change trajectory for individual i in the population

γ_{00} = population average of the level-1 intercepts, π_{0i} , for individuals with a level-2 predictor value of 0.

γ_{10} = population average of the level-1 slopes, π_{1i} , for individuals with a level-2 predictor value of 0.

u_{0j} = deviation of the cluster mean from the overall mean

u_{1j} = deviation of the cluster slope from the overall slope

i = individual airline

j = time period

Writing Equations 4 and 5 more specifically to this study and including all predictor variables yields Equations 6 (Level - 1) and 7 (Level - 2). The final model will only include significant predictors.

$$\begin{aligned} Y_{ij} &= \pi_{0i} + \pi_{1i} TIME_{ij} + \pi_{2i} RATM_{ij} + \pi_{3i} CATM_{ij} + \pi_{4i} FTE_{ij} \\ &+ \pi_{5i} CAPEX_{ij} + \pi_{6i} AFTE_{ij} + \pi_{7i} LF_{ij} + \pi_{8i} MFTE_{ij} + \pi_{9i} DFTE_{ij} \\ &+ \pi_{10i} HACFT_{ij} + \pi_{11i} MACFT_{ij} + \pi_{12i} AACFT_{ij} + \pi_{13i} DE_{ij} + \pi_{14i} DIP_{ij} \\ &+ \pi_{15i} DEBT_{ij} + \pi_{16i} WC_{ij} + \pi_{17i} CEO_{ij} + + \pi_{18i} ASTS_{ij} \\ &+ \pi_{19i} FLEET_{ij} + \pi_{20ij} NCA_{ij} + \varepsilon_{ij} \end{aligned} \tag{6}$$

Where:

Y_{ij} = dependent variable

π_{0i} = intercept of the true change trajectory for individual *i* in the population

π_{xi} = slope of the true change trajectory for individual *i* in the population for *x* independent variable

ε_{ij} = random measurement error

i = individual air carrier

j = time period

$$\begin{aligned}
\pi_{0i} &= \gamma_{00} + u_{0i} \\
\pi_{0i} &= \gamma_{00} + u_{0i} \\
\pi_{1i} &= \gamma_{10} + u_{1i} \\
\pi_{2i} &= \gamma_{20} + u_{2i} \\
\pi_{3i} &= \gamma_{30} + u_{3i} \\
\pi_{4i} &= \gamma_{40} + u_{4i} \\
\pi_{5i} &= \gamma_{50} + u_{5i} \\
\pi_{6i} &= \gamma_{60} + u_{6i} \\
\pi_{7i} &= \gamma_{70} + u_{7i} \\
\pi_{8i} &= \gamma_{80} + u_{8i} \\
\pi_{9i} &= \gamma_{90} + u_{9i} \\
\pi_{10i} &= \gamma_{100} + u_{10i} \\
\pi_{11i} &= \gamma_{110} + u_{11i} \\
\pi_{12i} &= \gamma_{120} + u_{12i} \\
\pi_{13i} &= \gamma_{130} + u_{13i} \\
\pi_{14i} &= \gamma_{140} + u_{14i} \\
\pi_{15i} &= \gamma_{150} + u_{15i} \\
\pi_{16i} &= \gamma_{160} + u_{16i} \\
\pi_{17i} &= \gamma_{170} + u_{17i} \\
\pi_{18i} &= \gamma_{180} + u_{18i} \\
\pi_{19i} &= \gamma_{190} + u_{19i} \\
\pi_{20i} &= \gamma_{200} + u_{20i}
\end{aligned} \tag{7}$$

Where:

π_{0i} = intercept of the true change trajectory for individual i in the population

π_{xi} = slope of the true change trajectory for individual i in the population for x independent variable

γ_{00} = population average of the level-1 intercepts, π_{0i} , for individuals with a level-2 predictor value of 0

γ_{x0} = population average of the level-1 slopes, π_{1i} , for individuals with a level-2 predictor value of 0 for x independent variable

u_{0j} = deviation of the cluster mean from the overall mean

u_{xj} = deviation of the cluster slope from the overall slope for x independent variable

i = individual airline

j = time period

After data exploration, the basic model was built. The first two simple models constructed were an unconditional means model and an unconditional growth model. Unconditional models partition and quantify the outcome variation across people without regard to time and across people and time (Singer & Willett, 2003). These initial results establish whether there is a systematic variation in the outcome worth exploring (Singer & Willett, 2003).

The final process includes building the multilevel model by starting with a basic model where all parameters are fixed and then adding random coefficients as appropriate and exploring confounding variables (Singer & Willett, 2003). Predictors were entered, retained, and removed based on a combination of logic, theory, and prior research, supplemented by judicious hypothesis testing and comparison of model fit. The subset of models presented are an unconditional means model, an unconditional growth model, and the final model. SPSS 18 (2014) software was used for descriptive statistics, data preparation, and multilevel modeling.

This study has a number of strengths due to its design. The use of MLM allows for an air carrier to be measured for restructuring actions over time rather than at just one point in time. As described in the next section, the air carriers used are the entire population with data available. Also, the use of the W-Score for the dependent variable is a further strength as it measures air carrier performance by multiple characteristics.

Population/Sample

The population selected for this study includes all large U.S. air carriers that have emerged from Chapter 11 bankruptcy since 1979. Large U.S. air carriers are defined by the U.S. Department of Transportation (2013) as operating aircraft over 60 seats or with a payload greater than 18,000 pounds. The collection of longitudinal data using all air carrier data available for the study creates no sampling issues with the associated data as experienced in other studies with this design (Goll & Rasheed, 2011). Data collected for the identified air carriers was measured quarterly. Air carriers that have emerged from bankruptcy where data are available are shown in Table 8.

Upon review of the population of 40 airlines that emerged from Chapter 11, 25 were large air carriers. These 25 air carriers were the complete population of large U.S.

air carriers that emerged from Chapter 11 bankruptcy. Rather than a sample, this analysis used the entire population.

Table 8. *Large air carriers that have emerged from bankruptcy.*

Date Filed	Year	Air Carrier	Chapter	Date Emerged	Duration (days)
01/05/10	2010	Mesa Air	11	01/20/11	380
10/06/08	2008	Sun Country	11	02/01/11	848
04/11/08	2008	Frontier Airlines	11	10/01/09	538
10/13/05	2005	Mesaba Airlines	11	04/24/07	558
09/14/05	2005	Delta Air Lines	11	04/25/07	563
09/14/05	2005	Northwest Airlines	11	05/18/07	611
09/14/05	2005	Comair	11		
12/30/04	2004	Aloha Airlines	11	02/17/06	414
10/26/04	2004	ATA Airlines	11	02/28/06	490
09/12/04	2004	US Airways	11	09/27/05	375
01/30/04	2004	Atlas Air/Polar Air Cargo	11	07/01/04	153
03/21/03	2003	Hawaiian Airlines	11	06/02/05	791
12/09/02	2002	United Airlines	11	02/02/06	1513
08/11/02	2002	US Airways	11	03/31/03	230
01/02/02	2002	Sun Country Airlines	7	04/15/02	97
12/13/00	2000	Allegiant Air*	11	03/01/02	443
05/01/00	2000	Kitty Hawk	11	08/05/02	826
06/30/95	1995	Trans World Airlines	11	08/24/95	54
09/21/93	1993	Hawaiian Airlines	11	09/12/94	351
06/08/92	1992	Markair	11	05/04/94	686
01/31/92	1992	Trans World Airlines	11	11/03/93	633
06/27/91	1991	America West Airlines	11	08/25/94	1138
12/03/90	1990	Continental Airlines	11	04/27/93	854
09/24/83	1983	Continental Airlines	11	09/02/86	1074
05/13/82	1982	Braniff International	11	09/01/83	476

*Classified as a commuter air carrier during a portion of restructuring period

Sources of the Data

Data available for analysis are available primarily through DOT Form 41 submissions by air carriers. These submissions include balance sheet and income statement financial data. Operating metrics such as passengers carried and miles flown are also available from the DOT. Twenty-five air carriers were identified that emerged from bankruptcy between 1979 and 2013 where quarterly financial and operational data are available. Additionally, fleet count and employee headcount is available from the DOT. Management changes, and DIP financing were collected by searching the LexisNexis database for published news articles containing keywords such as debtor-in-possession financing, DIP financing, post-petition financing, bankruptcy, and CEO, similar to Naujoks (2012).

All air carriers studied submitted financial and operational Form 41 data to the U.S. Department of Transportation. Data was collected manually from archival sources:

- U.S. Security Exchange Commission (annual reports)
- Airlines for America (air carrier bankruptcy list)
- U.S. Department of Transportation (Form 41 data)
- U.S. Department of Commerce (gross domestic product)
- U.S. Energy Information Administration (jet fuel price)
- Company website (annual reports)
- LexisNexis (press release)

Treatment of the Data

Multilevel models are an extension of regression, and all of the assumptions of regression apply (Field, 2009). However, the assumptions of independence and independent errors were not required because the purpose of a multilevel model is to handle the lack of independence between multiple measurements on the same air carrier (Field, 2009). As such, the following assumptions specified by Field (2009) were checked and discussed in Chapter IV:

- Variable types: The predictor variable is quantitative or categorical, and the predictor variables are quantitative and continuous (Assumption met)
- Non-zero variance: Indicates that the predictors should have a variance other than zero (Figure G2)
- No perfect multicollinearity: Correlation between predictors should be less than 0.80 (Table A1)
- Homoscedasticity: Variance of the residuals should be constant (Figures 9 and G2)
- Normally distributed errors: Errors are normally distributed with a mean of zero (Figures 10 and G1)

Singer and Willett (2003) also advise checking the functional form of the outcome variable versus the predictors by using plots at level 1 and 2. This is to verify that the data fits the assumed model (i.e., linear, quadratic, cubic). Singer and Willett (2003) suggest checking normality and homoscedasticity by visually inspecting plots of the residual distributions and the raw residuals against predictors. In this study, numerous models were developed to identify the final models. Instead of checking assumptions for each model, Singer and Willett (2003) suggest that assumptions be examined for several initial models and all final models.

As instructed by Singer and Willett (2003), data were arranged in a person-period format. *Person* in this study refers to an individual air carrier. Prior to model specification, a visual inspection of growth plots was performed on P-Score versus time. At this point, the model was specified as linear or curve linear, smooth or jagged, and continuous or disjoint. Singer and Willett (2003) recommend erring on the side of parsimony and postulate a simple linear model during model construction.

Preliminary analysis was also conducted on each independent variable. Plots were created for each to observe intercepts and slopes. As recommended by Singer and Willett (2003), bivariate plots and sample correlations were conducted to identify multicollinearity. Outliers were identified and removed or corrected if they were determined to be a keystroke error. The time-invariant predictors were centered around their grand means so the parameter estimates change very little with the inclusion of additional predictors (Singer & Willett, 2003).

Descriptive Statistics. Descriptive analysis includes an empirical growth plot to evaluate change in absolute and relative terms, and each trajectory was plotted to summarize each air carrier's W-Score. The trajectories were plotted both nonparametrically and through a parametric approach using ordinary least squares (OLS) regression. Even though OLS regression assumes independence and homoscedasticity and these unlikely hold for the residuals, the estimates are useful for exploration analysis (Singer & Willett, 2003). After exploring the within-individual differences, the inter-individual differences were reviewed by plotting the entire set of smoothed individual trajectories with a nonparametric smoother and OLS regression.

Power. As defined by Field (2009), power is the ability to determine whether an effect exists in the population. To determine power in multilevel models, the following factors must be considered: sample size, significance level, study design, interclass correlation, number of groups, and number of cases per group (Field, 2009). In general, there should be more than 20 groups at the highest-level variable (Field, 2009). This study meets the recommendation with 25 groups at the highest level.

The covariance structure is a starting point for the computer software to begin estimating the model parameters (Field, 2009). Repeated measures studies often use a first-order autoregressive structure (Field, 2009); the present study does the same. Other structures such as unstructured, compound symmetric, heterogeneous compound symmetric, heterogeneous autoregressive, and Toeplitz were also tested and excluded based on deviance statistics.

Validity Assessment

Cross-Validation. To validate the model, K-fold cross-validation was conducted. This method is useful especially when data are sparse because the entire dataset is used for testing (Hastie, T., Tibshirani, R., & Friedman, J. H., 2009). To conduct this method, the data are randomly split into *K* roughly sized parts. When *K* equals 5, the data are split into 5 parts. First the model is trained on *K*-1 parts of the data and then tested on the remaining data. The training and testing process is conducted K times where each part is used as the validation data set.

Five or ten-fold cross validation is recommended by Breiman and Spector (1992) and Kohavi (1995). For this study, K will equal 5 due to the computing time for creating each multilevel model and so that each section has an adequate amount of data. The data in this study have a hierarchical structure and must be split at the highest level by air carrier. The air carriers were randomly split into five parts for cross-validation. The prediction error was calculated for each of the five models and then averaged to calculate the cross-validation prediction error as shown by (Afshartous, 1997) (Equation 8):

$$CV = \sum_{i=1}^{n} \left(y_i - \hat{y}_i^{-k(i)} \right)^2 , \tag{8}$$

Where:

CV = cross-validation prediction error

y_i = actual value from test data

$\hat{y}_i^{-k(i)}$ = represents the predicted value for the observation i that is computed with the $k(i)$th part of the data removed.

n c = number of prediction errors calculated, in this case n equals K

Guided by literature as described in Chapter IV, the model with the smallest predictive mean squared error (MSE) was selected as the final model. The final model was then tested on the complete data set to calculate the MSE.

This longitudinal study used archival data submitted to the U.S. DOT by large air carriers that have filed Chapter 11 bankruptcy and then emerged from bankruptcy protection. Air carrier performance was measured by the dependent variable, W-Score, an air carrier financial distress metric. A multilevel exploratory factor analysis was conducted to explore underlying factors in air carrier specific metrics. A two-level multilevel growth model investigated the individual differences between air carriers emerging from bankruptcy over a period of three years. Results from the multilevel exploratory factor analysis and multilevel model are discussed in the following section.

CHAPTER IV

RESULTS

Quarterly data from 25 U.S. air carriers were collected for the three-year period after emerging from bankruptcy. Multilevel exploratory factor analysis (MEFA) was conducted to explore the underlying factor structure of the air carrier measurements and multilevel modeling (MLM) was used to identify the significant strategic actions affecting post-bankruptcy performance as measured by the untransformed P-Score, WSCR.

Descriptive Statistics

Descriptive statistics with outliers removed for each variable are shown in Table 9. Appendix A presents correlations between all variables with correlations greater than 0.80 shaded. This multicollinearity was avoided by the selection of variables for the MEFA and MLM. Variables selected for the MEFA and MLM were first determined by a review of correlations. The decision of which highly correlated variable to retain was made based on removing the variable that was highly correlated with multiple variables or was partially measured in another variable. For example, miles per aircraft (MAC) and hours per aircraft (HAC) are highly correlated, MAC was not included because similar information is measured in the retained variable, available ton miles per aircraft (AAC). Continuing this example, when developing the multilevel models, if HAC was found to not be a significant predictor, then HAC was removed and MAC was tested. This process with the MLM can be seen in Table E. In data preparation for MLM, all variables were centered on their grand mean and some variables were transformed through log transformation to address skewness as discussed in Chapter III.

Table 9. *Descriptive Statistics.*

	N	%	Minimum	Maximum	Mean	Std. Deviation
AAC	284	87%	376,866.3	72,633,432.0	9,755,222.8	11,765,643.6
AFTE	294	90%	9,773.3	1,463,488.4	140,261.2	246,305.1
ASTS	287	88%	4,620.5	33,273,098.0	4,574,169.3	8,045,947.8
CAPX	291	90%	-1,113,641.0	974,622.0	29,341.6	178,622.3
CATM	292	90%	0.0	2.6	0.8	0.4
CEO	292	90%	0.0	1.0	0.5	0.5
CGDP	317	98%	3,331.3	16,667.9	11,568.0	3,546.3
CJF	317	98%	0.4	3.9	1.6	1.0
CNOC	299	92%	45.0	125.0	108.7	16.1
CTIR	299	92%	9,237,888.0	51,526,880.0	34,252,627.6	11,030,705.9
DE	282	87%	-217.7	157.8	3.7	29.9
DEBT	287	88%	2,941.8	28,109,681.0	4,135,901.4	7,181,894.0
DFTE	296	91%	1.6	22.5	6.2	4.3
DIP	291	90%	0.0	1.0	0.6	0.5
DIPC	270	83%	0.0	2,000.0	284.6	610.6
FLET	284	87%	3.0	742.0	144.1	153.7
FTE	299	92%	45.0	76,954.0	13,483.2	16,382.4
HAC	284	87%	139.1	4,105.7	791.3	524.9
LF	297	91%	0.3	0.8	0.6	0.1
MAC	284	87%	59,991.4	1,981,921.9	347,918.2	245,300.9
MFTE	296	91%	1,069.3	14,697.5	4,693.5	2,451.7
NCA	287	88%	-1,960.0	26,923,705.0	3,475,252.4	6,286,400.0
RATM	292	90%	0.0	2.4	0.7	0.4
WC	288	89%	-3,415,404.0	879,676.0	-311,488.7	615,615.9
WSCR	288	89%	-13.5	19.5	-2.6	2.8

WSCR. Values of the dependent variable are shown in Figure 3. The average value of WSCR is -2.6 with a standard deviation of 2.8 (Table 9). The regression line in Figure 3 shows a slight decrease over TIME indicating that the average probability of bankruptcy decreases after emerging from bankruptcy. Each air carrier's WSCR is depicted separately in Appendix C. Table A shows that WSCR is not highly correlated (greater than 0.80) with any other variable and causing a multicollinearity problem.

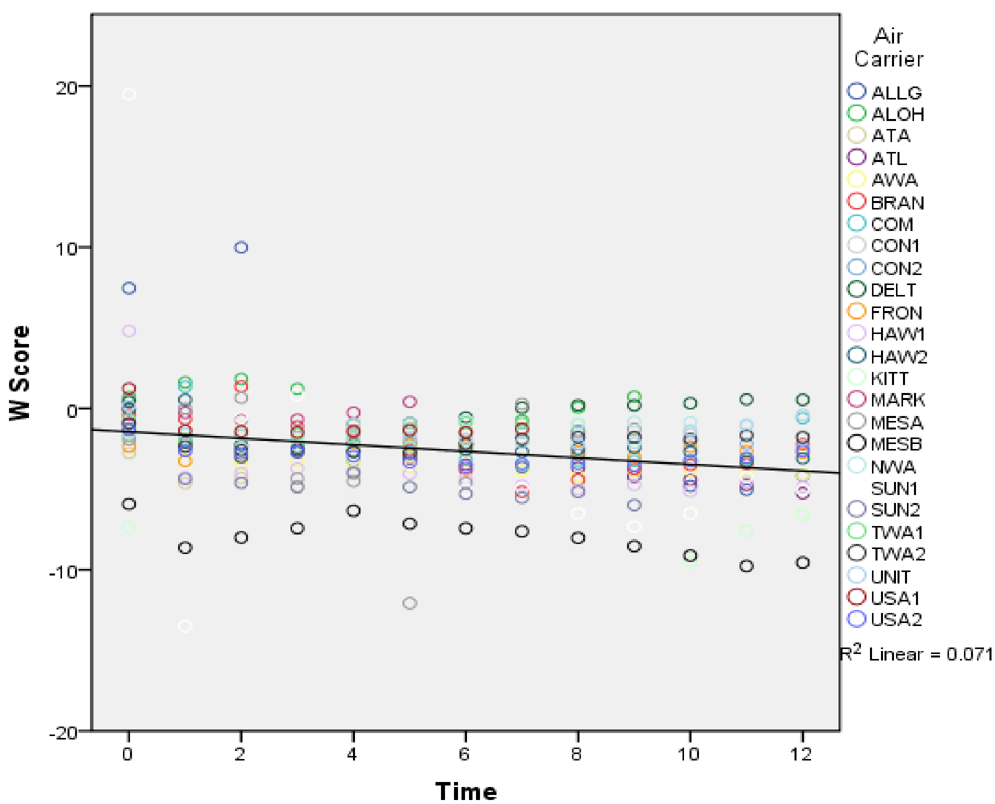


Figure 3. WSCR per quarter with regression line.

Missing Data

The percentage of missing data per variable is shown in Table 9. No variable has the total number of observations of 325 because some air carriers were not available for the complete three year post-bankruptcy period. Air carrier specific missing data is shown in Table 10. During MEFA, MPlus used all available data in Table 9 for analysis. By default, SPSS uses list wise deletion when conducting MLM and did not use all data described in Table 9. This deletion removed two air carriers from analysis: Atlas Air (ATL) and Trans World Airline's first bankruptcy (TWA1). ATL was excluded from MLM because of missing all values of available ton miles per employee (AFTE), which were removed when correcting for outliers. SPSS deleted TWA1 during MLM because of missing the number of aircraft per quarter for all periods. The number of cases excluded for each MLM dataset is shown in Table B1; other specific air carrier data collection issues are noted in Table B2.

Outliers

Histograms were used to identify erroneous outliers. The extreme and erroneous values in Table 11 were removed before analysis. Field (2009) recommends removing outliers with a z-score value greater than 3.29. The z-score values for each of the removed outliers are also presented in Table 11.

Table 10. *Air Carrier Missing Data.*

Air Carrier	Air Carrier ID	Qtrs. of Data Available (max. 13)		Reason
Allegiant Air	ALLG	13	100%	No missing data
Aloha Airlines	ALOH	10	77%	Liquidated
ATA Airlines	ATA	7	54%	Filed Chapter 11
Atlas Air/Polar Air Cargo	ATL	13	100%	No missing data
America West Airlines	AWA	13	100%	No missing data
Braniff International	BRAN	13	100%	No missing data
Comair	COM	13	100%	No missing data
Continental Airlines 1	CON1	13	100%	No missing data
Continental Airlines 2	CON2	13	100%	No missing data
Delta Air Lines	DELT	13	100%	No missing data
Frontier Airlines	FRON	13	100%	No missing data
Hawaiian Airlines 1	HAW1	13	100%	No missing data
Hawaiian Airlines 2	HAW2	13	100%	No missing data
Kitty Hawk	KITT	13	100%	No missing data
Markair	MARK	6	46%	Liquidated
Mesa Air	MESA	10	77%	Data unavailable at time of study
Mesaba Airlines	MESB	13	100%	No missing data
Northwest Airlines	NWA	12	92%	Merged with Delta
Sun Country 1	SUN1	13	100%	No missing data
Sun Country Airlines 2	SUN2	10	77%	Data unavailable at time of study
Trans World Airlines 1	TWA1	8	62%	Filed Chapter 11
Trans World Airlines 2	TWA2	13	100%	No missing data
United Airlines	UNIT	13	100%	No missing data
US Airways 1	USA1	8	62%	Filed Chapter 11
US Airways 2	USA2	13	100%	No missing data

Table 11. *Outliers Removed.*

Variable	Value	Air Carrier	Period	Z-Score	Reason for removal
CAPEX	8,069,967	DELT	12	45.0	Extreme value; Delta/NWA merger values combined for one period
DE	2,816	MESA	7	94.2	Extreme value; period equity inconsistent with surrounding periods
DE	-606	USA1	6	20.4	Extreme value compared to other periods
DE	-600	MESA	8	20.2	Extreme value; period equity inconsistent with surrounding periods
DE	-385	USA2	1	13.0	Extreme value; first period after bankruptcy, very inconsistent with subsequent
DE	-285	DELT	12	9.7	Extreme value; Delta/NWA merger values combined for one period
DEBT	44,173,320	DELT	12	5.6	Extreme value; Delta/NWA merger values combined for one period
ASTS	44,018,556	DELT	12	4.9	Extreme value; Delta/NWA merger values combined for one period
NCA	35,000,000	DELT	12	5.0	Extreme value; Delta/NWA merger values combined for one period
AFTE	1.07-1.46	ATL	1-12	4.3-6.0	Extreme values of cargo air carrier ATL are not similar with all other air carriers

Multilevel Exploratory Factor Analysis

MEFA was conducted with MPlus using maximum likelihood estimation and oblique rotation. The variables included in the MEFA were selected based on correlations; variables, load factor (LF), and departures per employees (DFTE) were removed due to negative residual variances causing no convergence in the model. The interclass correlations (ICCs) for each variable are shown in Table 12. The ICCs measure the proportion of variance at the air carrier level or the individual level. ICCs close to zero indicate that the majority of the variation is within each air carrier. ICCs close to one indicate the majority of the variance is between each air carrier.

Table 12. *Interclass Correlations.*

Variable	ICC
CATM	0.74
AAC	0.85
WC	0.64
MFTE	0.78
CAPX	0.10
DE	0.06
DIPC	0.88
HAC	0.79
DEBT	0.99
FLET	0.97

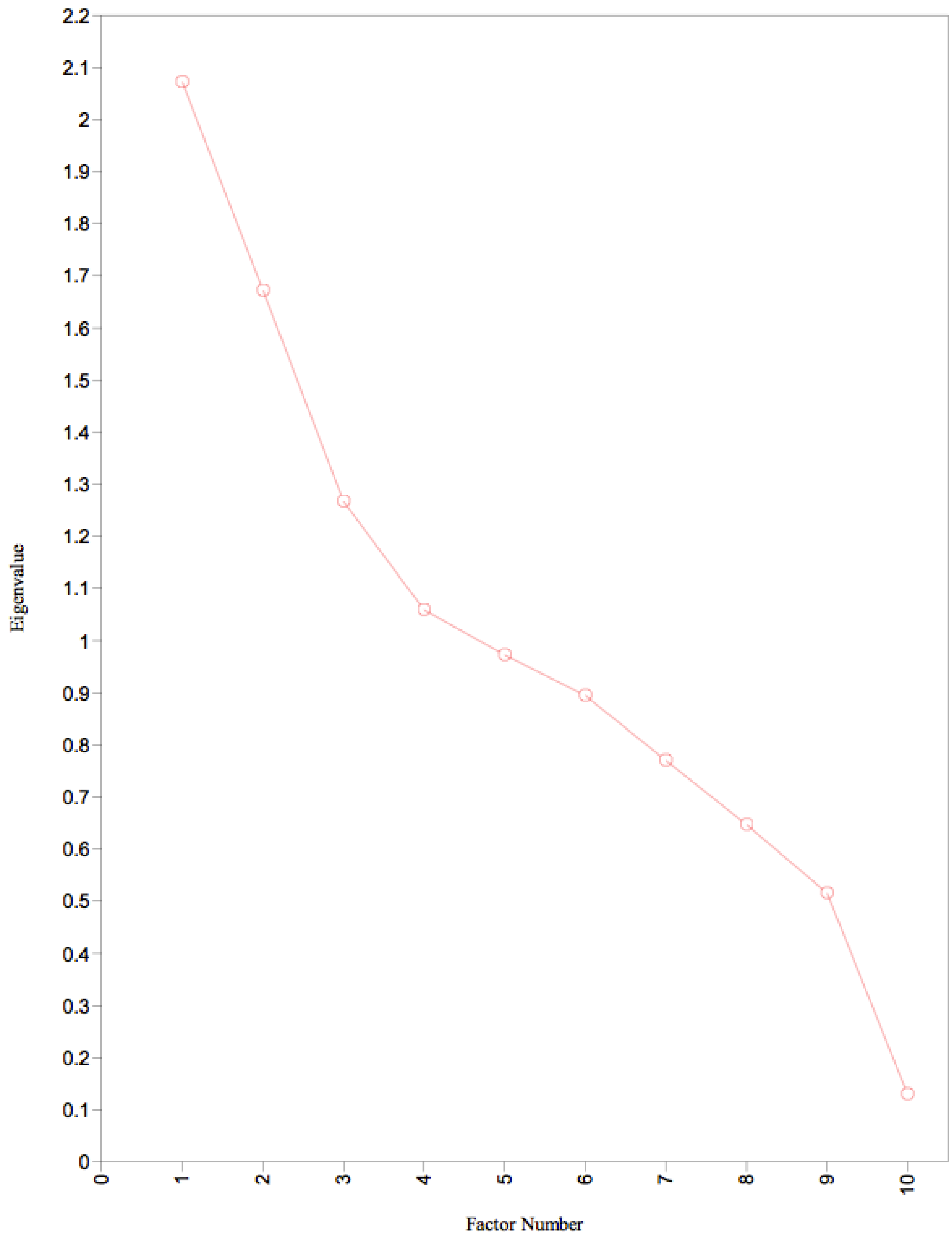


Figure 4. Scree plot.

The scree plot at the within level is shown in Figure 4. The scree plots show the number and strength of factors present in the analysis. The inflection point on the scree plot for the within level indicates three or four factors. A model was also run where the factor structure was unrestricted at the between level. An unrestricted model at the between level assumes perfect fit and enhances the process of identifying a sufficient number of factors at the within level (Muthen & Asparouhov, 2009).

Multilevel exploratory factor analysis was conducted with three and four factors at the within level and one factor (representing each air carrier) at the between level. Only one factor was used at the between level because this study was only using variables specific to the within level. Tables 13 (restricted) and 14 (unrestricted) depict the factor loadings for the three and four factor rotations. The unrestricted model corroborates the restricted model with the same significant variables found in each factor.

Table 13. *Factor Structure – 3 and 4 Within Factors and 1 Between Factor.*

	Three Factor Rotation			Four Factor Rotation			
	1	2	3	1	2	3	4
CATM	0.963	-0.070	-0.031	-0.089	-0.156	-0.049	-0.050
CAPX	0.029	-0.029	0.144	-0.036	0.002	0.181	-0.052
HAC	-0.094	1.375	-0.081	0.985	0.121	-0.104	-0.013
AAC	-0.075	0.624	-0.132	0.872	0.056	-0.117	0.060
DE	-0.072	-0.001	-0.157	0.005	0.012	-0.073	0.199
DEBT	0.020	0.000	0.529	0.029	-0.017	0.416	-0.324
WC	-0.046	0.007	-0.221	0.073	0.027	-0.006	0.627
DIPC	0.069	0.028	-0.465	0.005	0.017	-0.258	0.313
FLET	-0.039	-0.085	0.519	-0.153	-0.011	0.975	-0.041
MFTE	-0.346	0.201	-0.072	0.204	2.130	-0.025	0.086

Factor loading greater than |.30| are shaded

Table 14. *Factor Structure – 3 and 4 Within Factors and Unrestricted Between.*

	Three Factor Rotation			Four Factor Rotation			
	1	2	3	1	2	3	4
CATM	0.986	-0.072	-0.025	-0.137	-0.091	-0.047	-0.049
CAPX	0.035	-0.030	0.141	0.001	-0.040	0.170	-0.059
HAC	-0.094	1.376	-0.080	0.107	0.993	-0.105	-0.009
AAC	-0.075	0.622	-0.133	0.050	0.863	-0.118	0.063
DE	-0.068	0.001	-0.181	0.010	0.009	-0.097	0.210
DEBT	0.019	0.000	0.528	-0.015	0.027	0.415	-0.322
WC	-0.041	0.007	-0.234	0.023	0.069	-0.008	0.644
DIPC	0.066	0.027	-0.464	0.016	0.004	-0.252	0.316
FLET	-0.038	-0.084	0.514	-0.011	-0.152	0.984	-0.047
MFTE	-0.337	0.202	-0.075	2.412	0.206	-0.025	0.085

Factor loading greater than |.30| are shaded

Fit statistics for the two models, restricted and unrestricted, are shown in Table 15. As summarized by Rosenberg and Cizek (2009), adequate fit is indicated by Chi-square $p < .05$, Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) ≥ 0.95, Root Mean Squared Error of Approximation (RMSEA) ≤ 0.06, and Standardized Root Mean Squared Residual (SRMR) ≤ 0.08. With the exception of the Chi-Square Test and the TLI, the three and four factor models fit well. Based on the fit statistics, the four factor model fits slightly better. The adequacy of the four factor model at the within level is further verified with the unrestricted model showing a very good fit with all tests.

The MEFA factors are summarized in Table 16. The three factor model shows three factors in the areas of efficiency (financial and employee), aircraft utilization, and balance sheet metrics. The four factor model identified factors in the areas of aircraft utilization, employee efficiency, and balance sheet metrics.

Table 15. *Fit Statistics.*

Within Level Factors	Between Level Factors	Chi-Square Test	CFI	TLI	RMSEA	SRMR (within)	SRMR (between)
3	1	89.879* (53)	0.939	0.896	0.048	0.039	0.192
3	UN	21.732 (18)	0.994	0.969	0.000	0.039	0.000
4	1	73.184* (46)	0.955	0.911	0.045	0.018	0.191
4	UN	4.599 (11)	1.000	1.087	0.000	0.017	0.000

* $p < .05$; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Squared Error of Approximation; SRMR = Standardized Root Mean Squared Residual; UN = Unrestricted

The four factor model was identified as the most appropriate model due to better fit statistics. The results from the MEFA did not influence variable selection for the MLM. However, results from the MEFA further strengthen existing literature that supports the existence of four restructuring areas and use for developing a regression model.

Table 16. *Underlying Factors.*

Restructuring Areas	Factors	3-Factor	4-Factor
Operational	Efficiency	CATM	
		MFTE	MFTE
	Aircraft Utilization	HAC	HAC
		AAC	AAC
Portfolio/ Financial	Balance Sheet	DEBT	DEBT
		FLET	FLET
		DIPC	
Financial	Financing and Liquidity		DIPC
			WC
			DEBT

Multilevel Model

MLM was conducted on the air carrier data using SPSS software. Air carriers were first randomly assigned to a training dataset. Next, multilevel models were developed for each of the five datasets by including significant predictors. Over 200 models were fit to the data to test each predictor and identify five final models for each training data set. The five models were then cross-validated on test data and resulted in Model FL3 as the model of best fit.

Air Carrier Random Assignment. To perform 5-fold cross validation, air carriers were randomly assigned to five groups (Table 17). This random assignment created five training sets of data: L1, L2, L3, L4, and L5 (Table 18). The sample size for each data set is shown in Table B1.

Table 17. *Air Carrier Random Folds and Training Sets.*

Air Carrier Random Folds				
1	2	3	4	5
AWA	ALLG	FRON	ATL	ALOH
DELT	ATA	HAW1	CON1	COM
HAW2	BRAN	SUN2	MESB	CON2
KITT	MARK	TWA2	UNIT	MESA
SUN1	NWA	USA2	USA1	TWA1

Table 18. *Training and Testing Datasets.*

Training Data Set	Training Folds	Testing Fold
L1	2,3,4,5	1
L2	1,3,4,5	2
L3	1,2,4,5	3
L4	1,2,3,5	4
L5	1,2,3,4	5

Need for a Multilevel Model. To assess the need for a multilevel model, an empirical growth plot of W-Score over time for each air carrier was examined (Figures 3 and 5). The Figure 5 plot indicates that each air carrier's W-Score starts at different values and changes at different rates over time. Some plots show a large decrease initially while others stay relatively flat. Figure 3 is a scatter plot of WSCR with a regression line included. This regression line of best fit indicates a gradual negative slope over time. The decrease in WSCR represents a slight improvement overall in air carrier financial stress during the restructuring period. Singer and Willett (2003) also recommend visually inspecting individual growth trajectories to determine if WSCR changes over time.

Appendix C presents the varying initial values of WSCR and change over time by plotting each air carrier's specific WSCR separately. Some air carriers, such as ALOH and ATA, do not have values for the full three year period because of company liquidation. Most carriers made changes that gradually affected WSCR. However, ALLG, HAW1, and SUN1 implemented changes that had a large effect on WSCR. Also apparent from viewing the plots is that most air carriers show a visible decrease between T=0 and T=1; the period between these measurements represents time spent under bankruptcy protection.

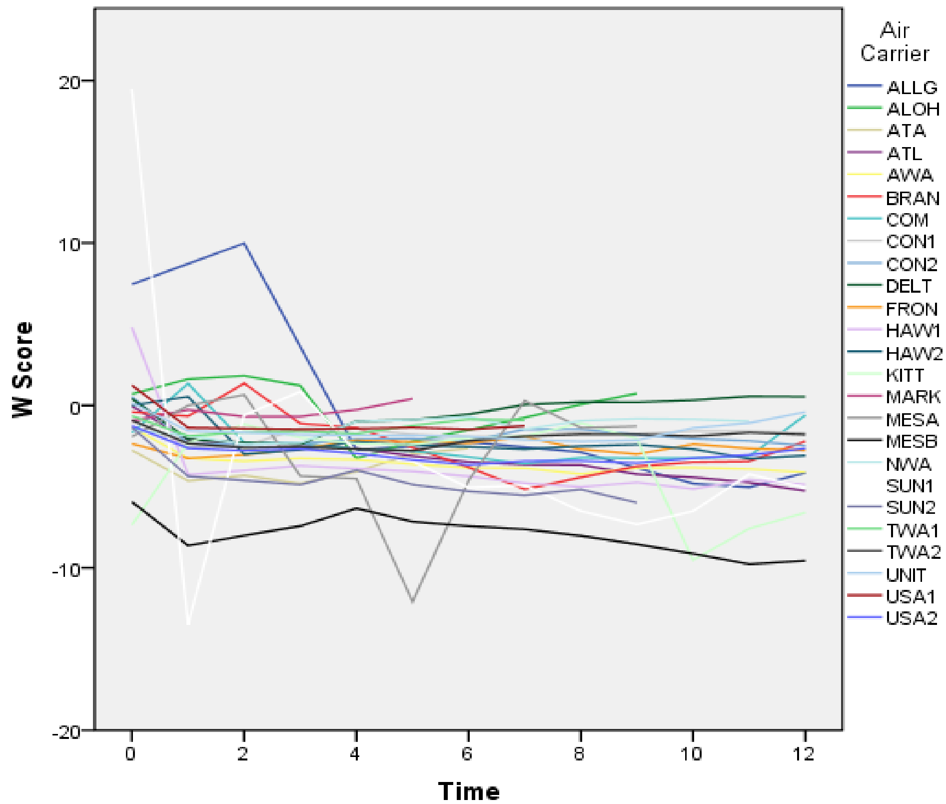


Figure 5. Growth plot of WSCR per quarter after bankruptcy.

Unconditional Model. Singer and Willett (2003) advise that the first model fit should be an unconditional means model where predictors are absent at every level. A first order autoregressive covariance structure was selected for the model in line with Field's (2009) recommendation for repeated measures data. This was confirmed as the correct choice by testing a variance component, a diagonal, and an unstructured covariance structure. Both the variance component and diagonal structure models fit worse as indicated by Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values. As described by Singer and Willett (2003), AIC and BIC values can be compared for any models as long as both are fit to the same set of data. The model with the smaller AIC or BIC values fits better (Singer & Willett, 2003). The unstructured covariance structure model was not used because it did not converge and is not ideal for data with many time periods (Singer & Willett, 2003) as is the case with the present study.

Table 19 shows the five unconditional models for each training set of data. Model A for datasets L1 and L4 have an intraclass correlation (ICC) of zero, indicating no variability at level 2 between the air carriers. Model A from data sets L2, L3, and L5 have ICCs of 0.289, 0.183, and 0.190, respectively. These ICC values indicate that 18 to 29% of the variance in WSCR is due to differences (level 2) among air carriers, and level 2 predictors could be used to further explain variation.

Table 19. *Unconditional Models.*

	Data L1 Model A		Data L2 Model A		Data L3 Model A		Data L4 Model A		Data L5 Model A	
Intercept	.548	(.460)	-.187	(.405)	.316	(.443)	.282	(.283)	.017	(.412)
Variance Components										
Level 1 (Within)	7.480***	(1.505)	5.875***	(.625)	8.709***	(1.415)	8.629***	(1.040)	7.787***	(1.364)
Level 1 rho	0.830***	(.036)	.055	(.117)	0.374**	(.124)	0.384***	(.090)	0.383**	(.139)
Level 2 (Between)	.000	(.000)	2.386*	(.989)	1.948	(1.226)	.000	(.000)	1.830	(1.128)
Level 2 rho (ICC)	.000		.289		.183		.000		.190	
Deviance										
AIC	755.088		1014.434		981.976		1041.462		1040.622	
BIC	768.201		1027.860		995.109		1054.908		1054.086	

Standard errors are in parentheses. ***$p \leq 0.001$ **$p \leq 0.01$ *$p \leq 0.05$

Unconditional Growth Model. The unconditional growth model is the unconditional model with time. For clarity of presentation, only models from dataset L3 are included within the text. The unconditional growth models for the other four training data sets are shown in Appendix D. The L3 data models were chosen for presentation because the L3 final model is most predictive. Table 20 contains the unconditional growth models fitted three times with TIME, $TIME^2$, and $TIME^3$ for data set L3. Guidance from Field (2009) was followed to fit the linear, quadratic, and cubic function of time. Quadratic time measures acceleration or deceleration in the rate of change of WSCR (Heck, Thomas, & Tabata, 2013). The cubic function of time measures the increase or decrease in the acceleration or deceleration in the rate of change of WSCR.

For each model, with only linear TIME added, the predictor was significant. All but data set L3 had a significant fit of both the linear and quadratic predictor of TIME. Only data set L2 had significant predictors of TIME, $TIME^2$, and $TIME^3$. With a time predictor added, the ICC for each model indicated a variation at level 2 between air carriers.

Pseudo R^2 values were calculated as guided by Singer and Willett (2003). As predictors are added, Pseudo R^2 values are used to measure the decrease in residual variance. The goal of adding predictors to a model is to further explain variation; this is indicated by an increase in Pseudo R^2. For example, TIME in data set L3 (Table 20) explains 19% of the within-air carrier (level 1) variation of WSCR. TIME and $TIME^2$, explain 21% of the within-air carrier variation, and adding $TIME^3$ explains an additional 1% for a total of 22%.

Following Singer and Willett (2003), Schwarz's Bayesian criterion (BIC) and Akaike's information criterion (AIC) were also used to evaluate model fit where smaller values indicate better fit. Values of BIC and AIC can be compared when the same data set is used such as between models fit only to L1 but not used to compare models fit on L1 and L2. AIC and BIC values on data sets L1 and L3 show a slight increase when $TIME^3$ was added. Linear TIME was selected as most appropriate due to model simplicity, as advised by Singer and Willett (2003), and because $TIME^2$ and $TIME^3$ do not substantially explain variance. Linear time is also supported by review of Figure 6. After adding time variables to each model, additional predictors were examined by creating conditional growth models.

Table 20. *Data L3 Unconditional Growth Models.*

	Model B		Model C		Model D	
Intercept	1.552	**	2.202	***	2.610	***
TIME	-.239	***	-.612	**	-1.163	**
TIME*TIME			.032		.156	
TIME*TIME*TIME					-.007	
Variance Components						
Level 1 (Within)	7.099	***	6.922	***	6.813	***
Level 1 rho	.192		.182		.170	
Level 2 (Between)	2.318	*	2.379	*	2.387	*
Level 2 rho (ICC)	.246		.256		.259	
Pseudo R2	0.185		0.205		0.218	
Goodness-of-fit						
Deviance						
AIC	971.313		969.896		970.053	
BIC	987.729		989.595		993.036	

****p* ≤ 0.001 ***p* ≤ 0.01 **p* ≤ 0.05*

Conditional Growth Models. The next step in multilevel analysis is to add predictor variables to the unconditional growth models, creating conditional growth models. Main effects of all predictor variables as described in Chapter III were added individually for each training data set. As discussed in the Descriptive Statistics section, all variables were considered for the MLM regardless of the results from the MEFA. The MEFA results support the existence of including variables to measure the four restructuring areas. Variable selection and retention was based on multicollinearity and significance as a predictor. Table E shows the process of adding and removing predictor variables to identify the final models of each data set. The final models presented in Table 21 were selected by reviewing the effect of each predictor on previous predictors, variance components, pseudo R^2, and deviance statistics as shown in Table E. Total debt (DEBT) and total assets (ASTS) were significant in all models and CATM was significant in all but L1 data. Pseudo R^2 values were much higher in data from L2, L4, and L5, indicating that approximately 36% of the variance within each air carrier was explained. Each model's AIC and BIC values are included, but because each model was fit to a different dataset, the values are not comparable. As concluded by Singer and Willett (2003), "… no statistical model is ever final; it is simply a placeholder until a better model is found" (p.105).

Table 21. *Conditional Growth Models.*

	Data L1		Data L2		Data L3		Data L4		Data L5	
	Model E		Model E		Model E		Model E		Model E	
Intercept	.744	(.675)	.428	(.529)	1.340*	(.589)	.801	(.404)	.567	(.482)
Time	-.161	(.074)	-.098*	(.046)	-0.169*	(.069)	-0.107	(.057)	-0.120*	(.057)
CATM			1.938**	(.682)	3.858***	(.804)	5.383***	(.737)	4.887***	(.783)
LF	6.145**	(2.205)	10.229**	(3.810)						
CTIR							-.0001***	(.000)	-.0001***	(.000)
HACFT	13.883**	(4.408)								
AACFT	-6.853**	(2.414)			4.876***	(1.429)			4.425***	(1.299)
DEBT	26.885***	(3.461)	30.426***	(4.535)	23.113***	(5.449)	23.416***	(4.378)	22.965***	(5.513)
ASTS	-23.657***	(3.430)	-30.052***	(4.451)	-22.816***	(5.270)	-22.010***	(4.219)	-21.808***	(5.374)
MACFT			8.883***	(1.983)						
MFTE			-.503**	(.162)						
Variance Components										
Within Level 1	7.104*	(3.475)	3.778***	(.455)	6.532***	(1.143)	5.429***	(.837)	4.985***	(.774)
rho	0.879***	(.060)	.155	(.164)	.402**	(.129)	.331**	(.130)	.350**	(.130)
Between	.451	(3.277)	3.085*	(1.550)	2.270	(1.313)	.206	(.502)	1.556	(.865)
ICC	.060		.450		.258		.037		.238	
Pseudo R^2	.050		.357		.250		.371		.360	
Deviance										
AIC	703.570		938.691		935.064		965.126		966.355	
BIC	736.352		975.613		964.613		995.378		1000.015	

Standard errors are in parentheses. ***$p \leq 0.001$ **$p \leq 0.01$ *$p \leq 0.05$

Cross-validation

Based on the five final models (Table 21), Equations 9 through 13 were tested on the appropriate data sets as described in Table 18. Table 22 shows the predictive mean squared error (MSE) for each data set.

FL1 AR(1)

$$\begin{aligned} Y_{ij} &= 0.74 - 0.16(TIME_{ij}) + 6.15(LF_{ij}) + 13.88(HACFT_{ij}) \\ &- 6.85(AACFT_{ij}) + 26.88(DEBT_{ij}) - 23.66(ASTS_{ij}) \end{aligned} \tag{9}$$

FL2 AR(1)

$$\begin{aligned} Y_{ij} &= 0.43 - 0.10(TIME_{ij}) + 1.94(CATM_{ij}) + 10.23(LF_{ij}) \\ &- .50(MFTE_{ij}) + 8.88(MACFT_{ij}) + 30.43(DEBT_{ij}) - 30.05(ASTS_{ij}) \end{aligned} \tag{10}$$

FL3 AR(1)

$$\begin{aligned} Y_{ij} &= 1.34 - 0.17(TIME_{ij}) + 3.86(CATM_{ij}) + 4.88(AACFT_{ij}) \\ &+ 23.11(DEBT_{ij}) - 22.82(ASTS_{ij}) \end{aligned} \tag{11}$$

FL4 AR(1)

$$\begin{aligned} Y_{ij} &= 0.80 - 0.11(TIME_{ij}) + 5.38(CATM_{ij}) - 0.0001(CTTR_{ij}) \\ &+ 23.42(DEBT_{ij}) - 22.01(ASTS_{ij}) \end{aligned} \tag{12}$$

FL5 AR(1)

$$\begin{aligned} Y_{ij} &= 0.57 - 0.12(TIME_{ij}) + 4.89(CATM_{ij}) - 0.0001(CTTR_{ij}) \\ &+ 4.42(AACFT_{ij}) + 22.97(DEBT_{ij}) - 21.81(ASTS_{ij}) \end{aligned} \tag{13}$$

Table 22. *Prediction Mean Squared Error.*

Data Set	Prediction MSE
L1	12.497
L2	18.624
L3	3.836
L4	14.686
L5	6.826

A review of the five final model's significant predictors is compared in Table 23. Variables TIME, DEBT, and ASTS are included in all models. LF was found to be significant in datasets FL1 and FL2. Variables HAC and MAC, and variables AAC and MFTE are highly correlated. CATM was significant in datasets FL2, FL3, and FL4. The control variable CTIR was only found significant in two of the datasets, FL4 and FL5.

The best final model was selected with guidance from literature. Hastie, Tibshirani, and Friedman, (2009) state that cross-validation is the most common method for estimating prediction error. They suggest, "Often a "one-standard error" rule is used with cross-validation, in which we choose the most parsimonious model whose error is no more than one standard error above the error of the best model" (p.244). Browne (2000) states that the purpose of cross-validation is "…to find a model that yields as small an overall discrepancy as is possible given a specific sample size" (p.130). In a dissertation titled, Essays of Model Selection, Chen (2009) concludes that "the model with the smaller mean squared errors is chosen as the best model" (p.47). Based on literature, the final model from the L3 data set was chosen as the best model. Not only is the L3 model most predictive, but it also is one of the three most parsimonious models by containing only five predictors. The final L3 model was then tested on the complete dataset yielding an MSE of 7.340; this value was the second smallest of all five models tested on the complete dataset.

Table 23. *Significant Predictors.*

	FL1	FL2	FL3	FL4	FL5
TIME	✓	✓	✓	✓	✓
DEBT	✓	✓	✓	✓	✓
ASTS	✓	✓	✓	✓	✓
LF	✓	✓			
HAC	✓				
MAC		✓			
AAC	✓		✓		✓
MFTE		✓			
CATM		✓	✓	✓	
CTIR				✓	✓

Shaded variables are high correlated

Final Model

This section provides a more detailed description of the final model from the L3 data set (Table 21). For the discussion of the effect of each significant predictor, it is assumed that all other predictors are held constant. A taxonomy of statistical models from the L3 data set is included in Appendix E; variables preceded by the letter T indicate they have been centered on their grand mean, and variables containing the word log indicate log transformation

TIME. Time is a statistically significant predictor of WSCR ($\beta = -0.17$, $p < .05$). For each additional quarter of time, WSCR decreases by 0.17.

CATM. Cost per available ton mile is a statistically significant predictor of WSCR ($\beta = 3.86$, $p < .001$). For each \$1.00 increase in cost per available ton-mile, WSCR increases by 3.86.

AAC. Available ton miles flown per aircraft is a statistically significant predictor of WSCR ($\beta = 4.876$, $p < .001$). For each 1% increase in ATM flown per aircraft, WSCR increases by 0.0488.

DEBT. Total debt is a statistically significant predictor of WSCR ($\beta = 23.11$, $p < .001$). For each 1% increase in debt, WSCR increases by 0.2311.

ASTS. Total assets are a statistically significant predictor of WSCR ($\beta = -22.82$, $p < .001$). For each 1% increase in assets, WSCR decreases by 0.2282.

To further understand the impact of a one unit change of each significant independent variable on the probability of bankruptcy, Table 24 is presented. The impact of a one unit increase on the average air carrier WSCR, at TIME zero, is converted to the change in the probability of bankruptcy as measured by P-Score. For example, all other variables constant, each additional three months after emerging from bankruptcy, the probability of bankruptcy decreases 4.25 percentage points. Figure 6 shows average P-Score plotted over time. P-Score was calculated, as discussed in Chapter III, by transforming WSCR to result in the probability of bankruptcy. As indicated by the chart, the probability of bankruptcy significantly decreases from the actions undertaken during bankruptcy protection. After emerging from bankruptcy, the probability of bankruptcy does not vary substantially. The average values over time of the remaining four predictors are shown in Appendix F.

Table 24. *Change to Probability of Bankruptcy.*

	Amount of Increase	Avg. WSCR (T = 0)	Avg. P-Score (T = 0)	Change to WSCR	Adj. WSCR	Adj. P-Score	Change to Probability of Bankruptcy (pts.)
TIME	One quarter (3 months)	0.13	53.32%	-0.17	-0.04	49.07%	-4.25
CATM	$1.00	0.13	53.32%	3.86	3.99	98.19%	44.87
Log Transformed Variables							
AACFT	1% (1.99 million ATM/aircraft)	0.13	53.32%	0.05	0.18	54.53%	1.21
DEBT	1% ($43.7 million)	0.13	53.32%	0.23	0.36	59.00%	5.68
ASTS	1% ($40.3 million)	0.13	53.32%	-0.23	-0.10	47.62%	-5.70

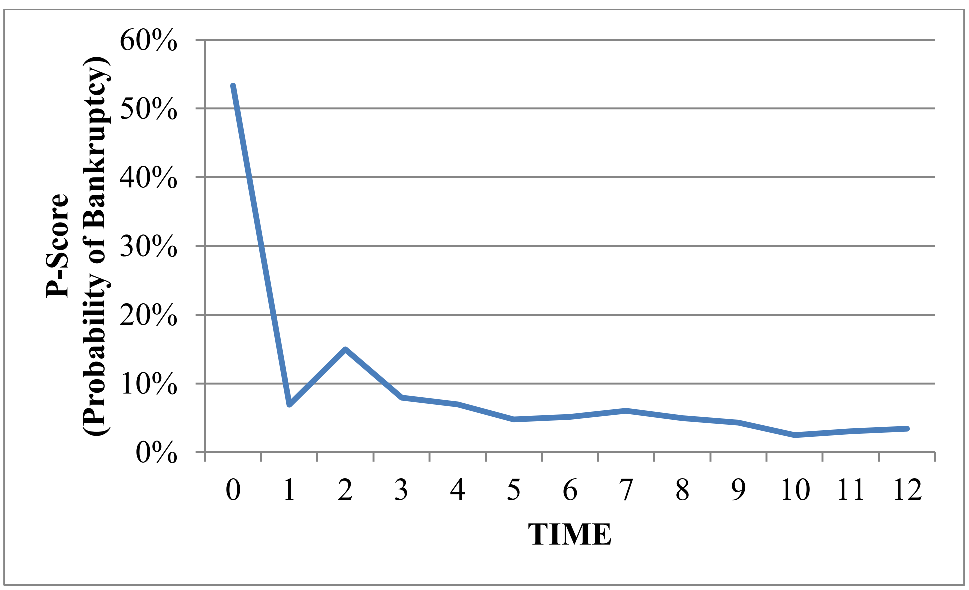


Figure 6. Average P-Score.

DIP. Debtor in possession financing was a significant predictor ($p < .001$) in four of the five data sets (L2, L3, L4, L5). However, it was removed from the final models for each data set because, when it was included, it caused TIME to no longer be a significant predictor. This is most likely due to DIP financing being measured as a dichotomous variable instead of continuous. The final model from the L3 data set was fit again with TIME removed and DIP added. DIP was significant ($\beta = -2.782$, $p < 0.001$), interpreted as a decrease in WSCR of -2.782 when DIP financing was secured. This resulted in a decrease of 46.71 points to the probability of bankruptcy when DIP financing is a restructuring action. Nine of the air carriers received no DIP financing. While DIP was not included in the final model due to the effect on TIME, its effect on decreasing bankruptcy probability is significant.

Residuals. Guided by Singer and Willett (2003), the assumptions of the final model (L3) were checked for normality and homoscedasticity. A plot of raw residuals and predicted values is shown in Figure 7. Field (2009) emphasizes that the plot should be a random array of dots; if the plot funnels out or any curve is visible, heteroscedasticity is present or the data has broken the assumption of linearity. Normality is tested by viewing a histogram of the residuals (Figure 8) and the normal probability plot (Figure G1). Both indicate the assumption of normality may not have been met. Homoscedasticity is checked by viewing plots of each predictor against residuals (Figure G2). If the assumption of homoscedasticity is met, the variability at every predictor value will be approximately equal (Singer & Willett, 2003). Some plots show more variability at each predictor value than others. While this may indicate the assumption of homoscedasticity is not met, the small sample size can make a definitive conclusion difficult (Singer & Willett, 2003).

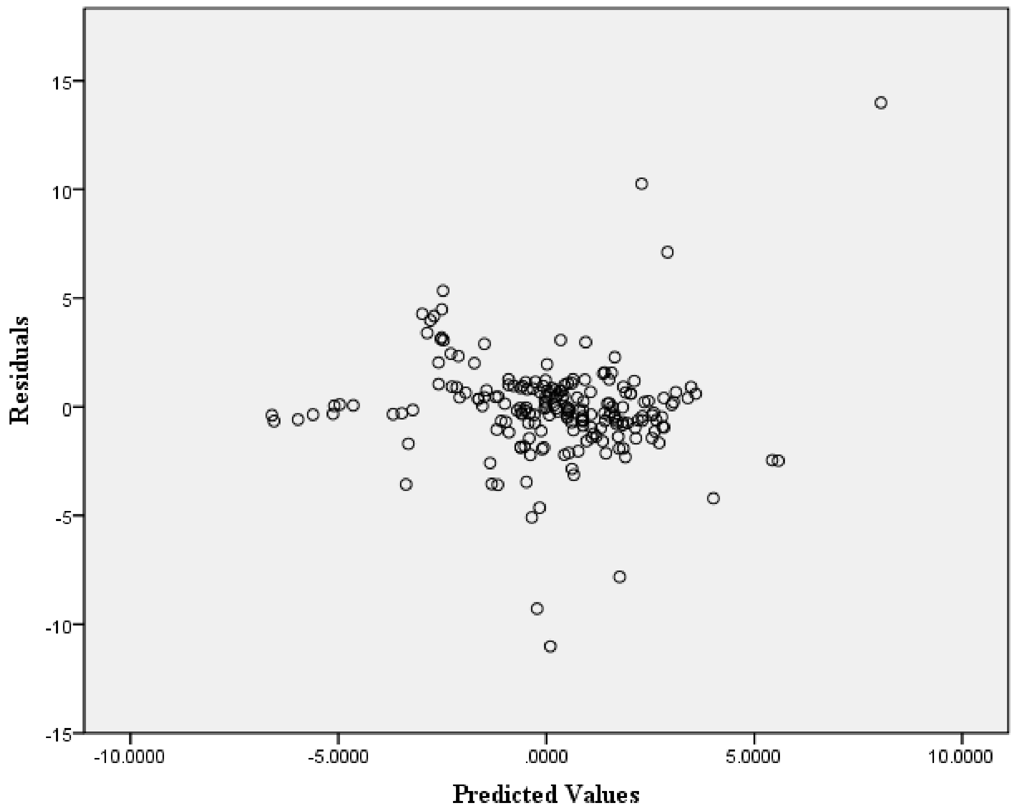


Figure 7. Predicted values vs. residuals.

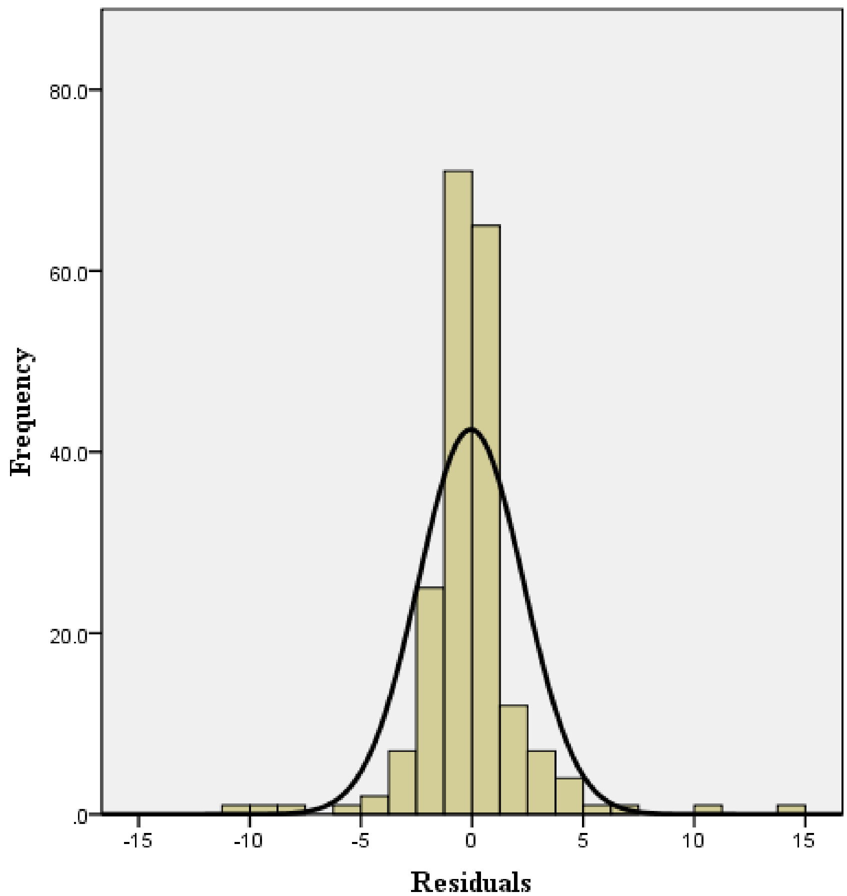


Figure 8. Histogram of residuals.

Summary

A multilevel exploratory factor analysis and multilevel model were fit to air carrier post-bankruptcy data. Underlying factors were discovered in the data that correspond with existing turnaround literature. Five final MLM models are presented with the best combination of significant predictors cross-validated against test data. The final model from the L3 dataset was chosen as the best fit to explain air carrier stress over time.

Methodology from Chapter III was followed, and results from the MEFA and MLM are included in the present chapter. The following chapter will further discuss interpretation of the factors identified with the MEFA and how they align with existing restructuring literature. The significant predictors of the final model identified from MLM will also be interpreted and discussed for theoretical and practical application.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This section explores the results of Chapter IV and answers the research questions posed in Chapter I. Findings from the multilevel exploratory factor analysis (MEFA) are discussed and conclusions are drawn from the results of the multilevel model (MLM). Lastly, recommendations are given for further research in the area of air carrier restructuring.

Discussion

A MEFA was conducted to further understand whether air carrier restructuring metrics cluster into the four restructuring areas of operational, financial, managerial, and portfolio as proposed in literature. Due to only one dependent variable measuring managerial restructuring, that variable was removed from the MEFA. Results from the MEFA indicate that the selected air carrier metrics factor into three restructuring areas, excluding managerial: operational, financial, and portfolio. In both the three factor and four factor MEFA, two operational factors were discovered: an efficiency factor and an aircraft utilization factor. Efficiency was measured by cost per available ton mile (CATM) and miles per employee (MFTE), a cost metric and an employee productivity metric. The aircraft utilization factor was measured by hours flown by aircraft (HAC) and tons flown per aircraft (AAC).

In the three factor model, a combined factor measuring portfolio and financial restructuring actions was indicated. This combination factor was composed of balance sheet variables: air carrier debt (DEBT), number of aircraft in fleet (FLET), and amount of DIP financing received (DIPC). In the four factor model, a fourth factor, financing and liquidity, was identified that measured the amount of DIP financing, working capital (WC), and DEBT. The four factor model was the best fit, as indicated by fit statistics, and most similar to restructuring literature. The results of the MEFA indicate that the four restructuring areas exist in air carrier metrics and are appropriate for regression.

The MLM identified five significant predictors in the final model. Control variables were not found to be significant predictors in the final model.

Time. As discovered with the unconditional growth models and the final L3 model, W-Score (WSCR) changed significantly over time. On average, WSCR was larger, indicating the highest probability of bankruptcy during the quarter filing bankruptcy (TIME=0). Subsequent to this period, WSCR decreased at .17 per quarter. This change equates to an average decrease in the probability of bankruptcy by 4.25 points per quarter over the restructuring period. Without any other changes to predictors in the model, the average air carrier begins with a bankruptcy probability of 53% and at the end of three years has a bankruptcy probability of 13%. Individual air carrier differences are shown in Appendix C.

Operational. Two of the predictors in the final model were operational restructuring metrics: CATM and available ton miles flown per aircraft (AACFT). A decrease of $1.00 per available ton mile, after bankruptcy filing, reduces the chance of a subsequent filing by 45 points. For passenger air carriers, this is equivalent to a decrease of $0.10 per passenger mile. The average value of CATM at T = 0 was $0.08 per passenger mile and at T = 12, $0.06 per passenger mile. This average $0.02 decrease in the cost per passenger mile reduced the average air carrier bankruptcy probability of 53.3% to 51.7% at the end of three years, all else remaining the same.

The coefficient of predictor AACFT was not in line with literature or the expected benefit of more available ton miles flown per aircraft. For each 1% (1.98 million ATMs at T = 0) increase in AACFT, the probability of bankruptcy increases by 2.2 points. The average value of AACFT at T = 0 was 198 million, and at T = 12 it was 190 million. This average decrease of 8 million ATMs decreased the average air carrier bankruptcy probability of 53.3% to 48.37% at the end of three years, all else remaining the same. Based on the results of the MLM, there is a significant relationship between operational restructuring and post-bankruptcy performance.

Financial. Only DEBT was found to be significant in the conditional growth model. As debt increased, the probability of bankruptcy also increased. The average value of debt over time, as shown in Figure F5, is slightly misleading. The large decrease at time 12 was due to Northwest Airlines merging with Delta Airlines. While this figure accurately depicts the average value of debt at T=12, this reaffirms the appropriateness of using MLM. Results are not affected by this average decrease because each air carrier is modeled individually. The MLM found that for every 1% increase in debt, the probability of bankruptcy as measured by WSCR increased 5.7 points. At T=0, a 1% change is equivalent to $43.7 million. The effect of DEBT on WSCR indicates there is a significant relationship between financial restructuring and post-bankruptcy performance.

While not included in the final model, debtor in possession financing (DIP) was also a significant predictor. As discussed in the results section, DIP was removed from the model because, when it was included, it caused TIME to no longer be a significant predictor. This effect on time is attributed to measuring DIP financing as a dichotomous variable instead of continuous. Fitting the model again with TIME removed results in a decrease of 46.71 points, to the probability of bankruptcy when DIP financing is a restructuring action at TIME zero. The effect of DIP on decreasing bankruptcy probability is very significant. It could be considered the strongest action a firm could take to improve financial stress. Acquiring DIP financing reduces the probability of bankruptcy by 46.71 points and the average decrease of WSCR among air carriers from TIME = 0 to T=12 was 46.42 points. However, considering DIP strictly as a management decision on whether or not to acquire is misleading. Prior to lending additional financing, lenders perform their own analysis of air carrier strength. The confounding issue that must be considered is that firms acquiring DIP financing received additional financing because they were most likely to be successful prior to being lent additional funds. The combination of a potentially stronger air carrier with additional financing resulted in significant improvement as measured by WSCR.

Managerial. The non-significance of whether or not the CEO was replaced is most likely a result of the measurement. In this study, measuring if the CEO was replaced only occurred if the replacement was made during the quarter of bankruptcy or during the restructuring period afterwards. Six air carriers (Table C2) replaced the CEO in the quarter prior to filing bankruptcy, but this study did not consider the effect of CEO replacement prior to bankruptcy. Future studies may explore the effect of replacing the CEO prior to bankruptcy.

Portfolio. The only significant portfolio variable was total assets (ASTS). The average value over time was very similar to DEBT, as shown in Figure F6. Like DEBT, the significant decrease in period 12 is due to Northwest Airlines no longer reporting values after merging with Delta Airlines. Again, missing data such as in this case does not cause an issue for MLM. The MLM found that for every 1% increase in assets, the probability of bankruptcy as measured by WSCR decreased 5.7 points. At T = 0, a 1% change is equivalent to $40.3 million. Rather than assuming this variable is used to only measure management changes during restructuring, it is also acting as a control variable for the size of the air carriers. The results of ASTS could indicate that the larger air carriers have less financial stress. However, considering the effect of DEBT as discussed above, a 1% increase in assets financed 100% with debt, nets to an approximate zero change to WSCR. In order for the larger firm to be less financially stressed, it must be financed with equity rather than debt. The interaction between DEBT and ASTS indicates that size of the air carrier does not matter as much as how the assets are financed. Whether an air carrier chooses to increase assets, for example through a merger, or reduce assets by selling aircraft or infrastructure, management's efforts should focus on relative debt reduction. The effect of ASTS on WSCR indicates there is a significant relationship between financial restructuring and post-bankruptcy performance.

Conclusions

This study examined the existence and effect of the four air carrier restructuring areas of operational, financial, managerial, and portfolio during the bankruptcy and post-bankruptcy period. Quarterly data from 25 U.S. air carriers were collected for the three-year period after emerging from bankruptcy. MEFA was conducted to explore the underlying factor structure of the air carrier measurements, and MLM was used to identify the significant strategic actions affecting post-bankruptcy performance as measured by the untransformed P-Score, WSCR.

The MEFA confirmed the existence of the four restructuring areas in the air carrier data. Additionally, the MEFA found two operational factors: an efficiency factor and an aircraft utilization factor. Future research may consider studying these factors separately when further analyzing operational restructuring strategies. Based on the results of the MLM, the research questions are addressed:

> RQ1: What is the relationship between operational restructuring on post-bankruptcy performance during the post-bankruptcy period?

There is a significant relationship between operational restructuring on post-bankruptcy performance during the bankruptcy and post-bankruptcy period. As the cost per available ton mile decreased, WSCR also decreased. This relationship is similar to restructuring literature in other industries where a lower cost of production is favorable for a firm.

Available ton miles flown per aircraft has an unexpected relationship with WSCR. As aircraft utilization decreases, or ATMs flown per aircraft, WSCR also decreases. This significant relationship is counter-intuitive as it contradicts business strategy of improving aircraft utilization. This unexpected relationship may indicate that WSCR is not ideal for measuring the effects of aircraft utilization. The weak correlation between WSCR and AAC shown in Appendix A furthers strengthens this proposal. As discussed in the recommendation section, additional dependent variables may be added to better capture the effect of aircraft utilization. Based on these results, it is important that management focuses on reducing operating costs.

RQ2: What is the relationship between financial restructuring on post-bankruptcy performance during the post-bankruptcy period?

There is a significant relationship between financial restructuring on post-bankruptcy performance during the bankruptcy and post-bankruptcy period. Total debt is a significant predictor of air carrier distress. Increasing debt has an adverse effect on performance. Debtor-in-possession financing is also a significant predictor and has a strong impact on post-bankruptcy performance. These results indicate management should attempt to reduce total debt to improve air carrier distress and that the approval of DIP financing is strongly related to post-bankruptcy performance.

RQ3: What is the relationship between managerial restructuring on post-bankruptcy performance during the post-bankruptcy period?

The results from this study showed no relationship between managerial restructuring on post-bankruptcy performance during the bankruptcy and post-bankruptcy period. While a relationship may exist when the CEO is replaced prior to bankruptcy, it is outside the scope of this study.

RQ4: What is the relationship between portfolio restructuring on post-bankruptcy performance during the post-bankruptcy period?

There is a significant relationship between portfolio restructuring on post-bankruptcy performance during the bankruptcy and post-bankruptcy period. Total assets are inversely related to post-bankruptcy stress; as assets increase, performance improves. Management must also consider the relationship of post-bankruptcy performance on debt when deciding whether or not to restructure assets.

Methodology and Data. Multilevel modeling is a very appropriate method for this research. Eight of the air carriers had missing data over the three year period. The ability of MLM to handle missing data made this study possible; without the use of these eight air carriers, there would be insufficient data for analysis. The Department of Transportation (DOT) dataset is also very useful because it was submitted by air carriers in a common format collected by the same entity for the 34 year period. This data consistency made treatment and analysis similar among air carriers. As some of the air carriers are no longer operating, DOT data are the only readily available data. As discussed in prior chapters, the main limitation in this study was minimal data. To maximize the number of air carriers available for analysis a large time period was used (1979 – 2012). While only 25 large air carriers are used for analysis, this included the entire population.

Measuring the restructuring period from the quarter of filing bankruptcy is also very beneficial. The public declaration of bankruptcy was a common signal identifying stress that was not dependent on other measurements. Using any other measurement to begin tracking restructuring performance may have been less obvious or conclusive. The design and data source made this study robust and appropriate for the research questions.

Practical and Theoretical Implications. This study has contributed theoretically and practically to air carrier restructuring theory. This is the first study to explore air carrier specific restructuring metrics for underlying factors and the first to measure restructuring strategies in all large air carriers that have emerged from Chapter 11 bankruptcy.

MEFA results show air carrier restructuring strategy factors to be similar with factors found in non-air carrier studies. In the 4-Factor model, two operational factors – a portfolio factor and a financial factor – were identified. This suggests that the four factor approach found in restructuring literature also applies to air carrier restructuring research.

This study is also the first to apply MLM to bankruptcy restructuring research. The robustness and versatility of MLM due to its ability to handle missing data and varying time periods make it appropriate for further application in the restructuring field. Additionally, this is the first study to measure the impact of restructuring factors on post-bankruptcy performance in the airline industry.

Practical contributions of this study include providing stakeholders, owners, debt holders, and management of bankrupt air carriers guidance for restructuring. Based on MLM results, each restructuring area, except managerial, has a significant influence on bankruptcy probability, as measured by WSCR. Air carrier management should strive to reduce the cost of transport per mile; CATM could be improved by reducing cost, increasing ATMs, or both.

As management seeks to employ financial and portfolio restructuring, it should direct its efforts toward reducing financial leverage in the firm. An equal reduction of debt and assets results in almost a net zero change in air carrier performance. The challenge for management is to reduce the ratio of debt to assets, thus decreasing financial stress. While management should seek to decrease leverage during the restructuring period, results show that acquiring DIP financing significantly reduced financial stress. This would indicate that if a bankrupt air carrier required additional financing for restructuring, DIP financing should be solicited. Acquiring DIP financing should be a strong indicator to external stakeholders that financial stress has significantly decreased. The strong effect of DIP financing may be partially due to lenders only financing the strongest of air carriers in bankruptcy. Either way, this study found that the most significant indication of improved financial stress is the receipt of DIP financing.

Based on this study, there is no relationship between managerial restructuring and air carrier financial stress during the period measured. The effect of CEO replacement that occurred prior to bankruptcy filing is outside the scope of this study. Additional research of managerial restructuring is needed to better understand this strategy among distressed air carriers. To improve air carrier performance during bankruptcy and restructuring, management should attempt to reduce the cost of transport, improve employee efficiency, consider deleveraging, and acquire DIP financing.

Recommendations

Future research in the area of air carrier restructuring will benefit greatly from additional data. Additional data will allow for the inclusion of level 2 predictors to explain variance associated with differences between passenger and cargo air carriers along with differences in air carrier size. Adding additional level 2 predictors may also appropriately capture the effects of variables such as AAC where an inverse relationship exists between aircraft utilization and air carrier success. Further, additional data may be obtained by expanding the scope of air carriers beyond the U.S.

Future research may consider using a multivariate growth model. Rather than use of a single dependent variable composed of a combined score of metrics, a multivariate growth model would allow the researcher to select a number of dependent variables. While a combined metric such as the W-Score has advantages, multiple dependent variables would give researchers more flexibility. Another addition to the multilevel model that may be useful is analysis with a cross-classified multilevel model. In a cross-classified multilevel model, measurements that belong to more than one air carrier can be explored. For example, in the case of the Delta Airlines bankruptcy, Comair filed bankruptcy the same day because it was a subsidiary. Measurements made of Comair also belonged to and were related to Delta Airlines. Cross-classified models may allow for further exploration of smaller subsidiary air carriers owned by larger air carriers.

Additional data would be useful for all of the recommendations in this section. However, a change that could be made to this study whether additional data were available or not, is adjusting the point at which turnaround actions is measured. As discussed earlier, this study may not have sufficiently captured CEO changes as a restructuring strategy due to measuring restructuring strategies beginning at bankruptcy filing. Future research may consider selecting another indicator of financial distress, rather than bankruptcy filing, to begin measuring restructuring actions and capture strategies employed earlier in the turnaround process.

This study introduced generic restructuring strategies to air carrier research. First, by exploring for underlying restructuring factors in air carrier metrics and secondly, through the application of multilevel modeling of air carrier restructuring strategies. Results from this study emphasize the importance of reducing air carrier operating costs while improving aircraft efficiency. These operating strategies coupled with DIP financing and decreasing relative debt result in reduced financial stress. Future research should consider additional dependent variables and level 2 predictors for further understanding of air carrier restructuring. Applying these recommendations by building upon this initial study will continue to fill the knowledge gap in air carrier restructuring.

REFERENCES

Afshartous, D. R. (1997). *Prediction in multilevel models*. Retrieved from http://directory.stat.ucla.edu/david-afshartous

Agarwal, V., Taffler, R. (2007). *Twenty-five years of the Taffler z-Score model : Does it really have predictive ability?* Edinburgh: University of Edinburgh Management School.

Airlines for America. (2013). U.S. airline bankruptcies and service cessations. Retrieved from http://www.airlines.org/Pages/U.S.-Airline-Bankruptcies-and-Service-Cessations.aspx

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance, 23*(4), 589-609.

Altman, E. I., & Hotchkiss, E. (2006). *Corporate financial distress and bankruptcy: Predict and avoid bankruptcy, analyze and invest in distressed debt*. Hoboken, N.J.: John Wiley & Sons.

Altman, E. I., Kant, T., & Rattanaruengyot, T. (2009). Post-chapter 11 bankruptcy performance: Avoiding chapter 22. *Journal of Applied Corporate Finance, 21*(3), 53-64.

Altman, E. I., & La Fleur, J. K. (1981). Managing a return to financial health. *Journal of Business Strategy (Pre-1986), 2*(000001), 31. Retrieved from http://search.proquest.com.ezproxy.libproxy.db.erau.edu/docview/209888671?accountid=27203

Antoniou, A. 1998. The status of the core in the airline industry: the case of the European market. *Managerial and Decision Economics, 19*(1): 43-54.

Arogyaswamy, K., Barker III, V. L., & Yasai-Ardekani, M. (1995). Firm turnarounds: an integrative two-stage model. *The Journal of Management Studies, 32*(4), 493.

Banker, Rajiv D., Chang, Hsi-Hui, Majumdar, Sumit K. (1993). Analyzing the underlying dimensions of firm profitability. *Managerial and Decision Economics, 14*(1), 25-36.

Ben-Yosef, E. (2005). *Evolution of the US Airline Industry.* The Netherlands: Springer.

Bethune, G., & Huler, S. (1998). *From worst to first behind the scenes of continental's remarkable comeback*. New York: Wiley.

Bibeault, D. B. (1981). *Corporate turnaround : How managers turn losers into winners*. New York: McGraw-Hill.

Bittlingmayer, George. (1990). Efficiency and entry in a simple airline network. *International Journal of Industrial Organization, 8*(2), 245.

Bogan, V., & Sandler, C. (2012). Are firms on the right page with chapter 11? An analysis of firm choices that contribute to post-bankruptcy survival. *Applied Economics Letters, 19*(7), 609-613.

Bowely, G. (2008, April 12). Frontier airlines files for bankruptcy. *New York Times.* Retrieved from: http://www.nytimes.com/2008/04/12/business/12frontiercnd.html?_r=0

Bragg, S. (2012). How to calculate capital expenditures. AccountingTools. Retrieved from: http://www.accountingtools.com/questions-and-answers/how-to-calculate-capital-expenditures.html

Breiman, L. and Spector, P. (1992). Submodel selection and evaluation in regression: the X-random case. *International Statistical Review, 60,* 291–319.

Browne, M. W. (2000). Cross-validation methods. *Journal of Mathematical Psychology*, *44*(1), 108-132.

Brown, S. R. (1997). *The history and principles of Q methodology in psychology and the social sciences.* Paper presented at the Red at the British Psychological Society Symposium on A Quest for a Science of Subjectivity: The Lifework of William Stephenson, University of London.

Buffett, W. (2013). Question and answer period. *Berkshire Hathaway Annual Meeting of Shareholders,* Omaha, Nebraska.

Button, K. (1996). Liberalising European aviation: is there an empty core problem? *Journal of Air Transport Economics, 30*(3), 275 – 291.

Chen, G. (2009). Essays of Model Selection using Bayesian Inference. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3386776)

Chow, G., Gritta, R. D., & Leung, E. (1991). A multiple discriminant analysis approach to gauging air carrier bankruptcy propensities: The airScore model. *Journal of the Transportation Research Forum, 31*(2), 371-377.

Ciliberto, F., & Schenone, C. (2012). Are the bankrupt skies the friendliest? *Journal of Corporate Finance Journal of Corporate Finance, 18*(5), 1217-1231.

Ciliberto, F., & Schenone, C. (2012). Bankruptcy and product-market competition: Evidence from the airline industry. *INDOR International Journal of Industrial Organization, 30*(6), 564-577.

Corridore, J. (July 2013). *Airlines.* (Industry Survey). New York, NY: Standard & Poor's.

Cross, R. M. (2004). Exploring attitudes: the case for Q methodology. *Health Education Research, 20*(2), 206-213.

Das, S., & LeClere, M. (2003). The survival of marginally-distressed firms: Evidence on the duration of turnaround. Retrieved from: http://ssrn.com/abstract=481342

Denis, D. K., & Rodgers, K. J. (2007). Chapter 11: duration, outcome, and post-reorganization performance. *Journal of Financial and Quantitative Analysis, 42*(1), 101.

Dowdell, E. M. (2006). The chapter 11 "Shuttle"—Coincidence or competitive strategy? *The Journal of Air Law and Commerce, 71*(4), 669-689. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=ofm&AN=502522603&site=ehost-live

Eckbo, B. E. (2008). *Handbook of empirical corporate finance.* Burlington: Elsevier.

Eichner, T. (2010). *Restructuring and turnaround of distressed manufacturing firms: An international empirical study.* Frankfurt am Main: Peter Lang.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4(*3), 272-299.

Field, A. P. (2009). *Discovering statistics using SPSS : (and sex and drugs and rock 'n' roll)*. London: SAGE Publications.

Gittell, J., Cameron, K., & Lim, S. (2007). Relationships, layoffs, and organizational resilience: airline industry responses to September 11. *Human Resources Abstracts, 42*(3), 300-329.

Goll, I., & Rasheed, A. A. (2011). The effects of 9/11/2001 on business strategy variability in the US air carrier industry. *Management Decision, 49*(6), 948-961.

Goll I., & Rasheed A.A. (2011). Environmental jolts, clocks, and strategic change in the U.S. airline industry: the effects of deregulation and the 9/11/2001 terrorist attacks. *Business and Politics, 13*(4), 1-35.

Goodfriend, J., Gritta, R. D., Adrangi, B., & Davalos, S. (2004). Assessing the financial condition of the major U.S. passenger airlines over the 1993-2003 period using the p-score and z score discriminant models. *Credit & Financial Management Review, 10*(4), 41-45, 47-48, 50-52. Retrieved from http://search.proquest.com.ezproxy.libproxy.db.erau.edu/docview/222536420?accountid=27203

Gritta, R., (1982). Bankruptcy risks facing the major U.S. airlines. *Journal of Air Law & Commerce, 48*(Fall), 89-107.

Gritta, R., Adrangi, B., Davalos, S., & Bright, D. (2008). A review of the history of air carrier bankruptcy forecasting and the application of various models to the US airline industry, 1980-2005. In Gratzer, K. & Stiefel, D. (Eds.), *History of insolvency and bankruptcy from an international perspective* (p. 193). Södertörns högskola: Huddinge.

Gritta, R., Jurinski, J., & Reed, L. (n.d.). *The use of a bankruptcy forecasting model in court proceedings: Reorganization versus liquidation decisions.* Portland, Oregan: University of Portland.

Gudmundsson, S. V. (2002). Airline distress prediction using non-financial indicators. *Journal of Air Transportation, 7*(2), 3-23.

Gudmundsson, S. V. (1999). Airline failure and distress prediction : a comparison of quantitative and qualitative models. *Transportation Research. Part E, Logistics and Transportation Review, 35E*(3), 155-182.

Gudmundsson, S. V. (1998). *Flying too close to the sun : the success and failure of the new-entrant airlines*. Aldershot, Hants, England: Ashgate.

Guzhva, V. S., & Pagiavlas, N. (2004). US commercial airline performance after September 11, 2001: Decomposing the effect of the terrorist attack from macroeconomic influences. *Journal of Air Transport Management, 10*(5), 327-332.

Hastie, T., Tibshirani, R., & Friedman, J. H. (2009). *The elements of statistical learning: Data mining, inference, and prediction*. New York: Springer.

Heck, R. H., Thomas, S. L., & Tabata, L. N. (2013). *Multilevel and longitudinal modeling with IBM SPSS.* New York: Routledge.

Heuer, J. S., & Vogel, M. H. (1991). Airlines in the wake of deregulation : Bankruptcy as an alternative to economic reregulation. *Transportation Law Journal, 19*(2), 247-286.

Hofer, C. W. (1980). Turnaround strategies. *Journal of Business Strategy Journal of Business Strategy, 1*(1), 19-31.

Hotchkiss, E. S. (1995). Postbankruptcy performance and management turnover. *The Journal of Finance, 50*(1), 3-21.

Hotchkiss, E. S. (1993). *Investment decisions under chapter 11 bankruptcy.* (Doctoral dissertation, New York University). Retrieved from ProQuest database. (Order No. 9411161)

Ito, H., & Lee, D. (2005). Assessing the impact of the September 11 terrorist attacks on U.S. airline demand. *Journal of Economics and Business,57*(1), 75-95.

Johnson, Herb., Stulz, René M. (1985). An analysis of secured debt. *Journal of Financial Economics, 14*(4), 501-521.

Kamel, Y. M. (2005). *A comparative study of the impact of turnaround strategies and leadership factors on successful corporate turnarounds* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 305355932)

Kieso, D. E. (2007). *Intermediate accounting.* New York: Wiley.

Kohavi, R. (1995). A study of cross-validation and bootstrap for accuracy estimation and model selection, International Joint Conference on Artificial Intelligence (IJCAI), Morgan Kaufmann, pp. 1137–1143.

Kroeze, C. (2005). *Predicting airline corporate bankruptcies using a modified Altman z-Score model.* (Doctoral dissertation, University of Nevada). Retrieved from ProQuest database. (Order No. 3186464)

Krueger, D. (1997). *Turnarounds and sustainable competitive advantage: An integration and study of decline and recovery.* (Doctoral dissertation). Purdue University, Indiana. Retrieved from ProQuest database. (Order No. 9818982)

Lai, J., & Sudarsanam, S. (1997). Corporate restructuring in response to performance decline: impact of ownership, governance and lenders. *European Finance Review, 1*(2), 197-233.

Lapre, M. A., & Scudder, G. D. (2004). Performance improvement paths in the U.S. airline industry: linking trade-offs to asset frontiers. *Production and Operations Management, 13*(2), 123-134. Retrieved from http://search.proquest.com.ezproxy.libproxy.db.erau.edu/docview/228757087?accountid=27203

Lawton, T., Rajwani, T., & O'Kane, C. (2011). Strategic reorientation and business turnaround: the case of global legacy airlines. *Journal of Strategy and Management, 4*(3), 215.

Liedtka, S. L.,. (1999). *Nonfinancial and financial performance measures: an empirical analysis of the airline industry.* (Doctoral dissertation). University of Maryland, Maryland. Retrieved from ProQuest database. (Order No. 9942994)

LoPucki, L. M., & Whitford, W. C. (1993). Patterns in the bankruptcy reorganization of large, publicly held companies. *Cornell Law Review, 78*(4), 597.

Lucarelli, A. (2003). Using the z-score as a turnaround tool. *Journal of Corporate Renewal,* (3), 1-13.

Mathiesen, M. C. (1996). Bankruptcy of airlines: causes, complaints and changes. *Journal of Air Law and Commerce, 61*(4), 1017-1045.

McArthur, A. W. (1984). *An empirical investigation of strategic groups and performance in the airline industry.* (Doctoral dissertation). University of Oregon. Retrieved from ProQuest database. (Order No. 8414860)

McCabe, R. M. (1998). *Why airlines succeed or fail a system dynamics synthesis.* (Doctoral dissertation). Claremont Graduate University. Retrieved from ProQuest database. (Order No. 9904232)

Michel, A., Shaked, I., & McHugh, C. (1998). After bankruptcy: can ugly ducklings turn into swans? *The Financial Analysts Journal, 54*(3) 31.

Moore, G. C., Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research Information Systems Research, 2*(3), 192-222.

Morrell, P. S. (2013). *Airline finance.* Farnham: Ashgate.

Muthén, B. & Asparouhov, T. (2009). Exploratory structural equation modeling. Structural Equation Modeling, 16, 397-438.

Muthén, L. K., & Muthen, B. O. (2005). *Mplus: Statistical analysis with latent variables: user's guide.* Los Angeles: Muthén & Muthén.

Muthén, L. K., & Muthen, B. O. (2010). *Mplus Discussion: Principal axis factoring.* Retrieved from: www.statmodel.com

Nahm, A. Y., Solís-Galván, L. E., Rao, S. S., & Ragu-Nathan, T. S. (2002). The Q-sort method: assessing reliability and construct validity of questionnaire items at a pre-testing stage. *Journal of Modern Applied Statistical Methods, 1*(1), 114-125.

Naujoks, M. B. (2012). *Restructuring strategies and post-bankruptcy performance.* (Unpublished doctoral dissertation). University of Munich.

Nyshadham, E.A. and Raghavan, S. (2001). The Failure of Electronic Markets in the Air Cargo Industry: A Core Theory Explanation. *Electronic Markets, 11*(4), 246 – 249.

O'Connor, W. E. (2001). *An introduction to airline economics*. Westport, Conn: Praeger.

Ofek, E. (1992). Capital structure and firm response to poor performance : An *empirical analysis*. New York, NY: New York University Salomon Center, Leonard N. Stern School of Business.

O'Neill, H. (1986). Turnaround and recovery: what strategy do you need? *Long Range Planning, 19*(1), 80-88.

Osborne, J. (2008). A brief introduction to hierarchical linear modeling. In J. Osborne (Ed.), *Best practices in quantitative methods* (pp. 444-451). Thousand Oaks, CA: SAGE Publications, Inc.

Oum, T. H., Fu, X., & Yu, C. (2005). New evidences on airline efficiency and yields: A comparative analysis of major North American air carriers and its implications. *Transport Policy, 12*(2), 153-164. doi:10.1016/j.tranpol.2005.01.002

Pandit, N. R. (2000). Some recommendations for improved research on corporate turnaround. *M@n@gement, 3*(2), 31-56. Retrieved from http://search.proquest.com.ezproxy.libproxy.db.erau.edu/docview/1022503323?accountid=27203

Pettigrew, A. M. (1990). Longitudinal field research on change: theory and practice. *Organization Science, 1*(3, Special Issue: Longitudinal Field Research Methods for Studying Processes of Organizational Change), 267-292. Retrieved from http://www.jstor.org.ezproxy.libproxy.db.erau.edu/stable/2635006

Phillips, G. M., & Sertsios, G. (2011). *How do firm financial conditions affect product quality and pricing?* Cambridge, Mass.: National Bureau of Economic Research.

Pilarski, A., & Dinh, T. (1999). Numerical scoring approach to credit risk analysis. In G.F. Butler and M.L. Keller, (Eds.), *Handbook of airline finance* (pp. 329-342). New York: Aviation Week: McGraw-Hill Companies.

Raudenbush, Stephen W., Bryk, Anthony S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks: Sage Publications.

Reise, S., Ventura, J., Nuechterlein, K., & Kim, K. (April 01, 2005). An illustration of multilevel factor analysis. *Journal of Personality Assessment, 84(*2), 126-136.

Robbins, D. K., & Pearce, J. A. (1992). Turnaround: retrenchment and recovery. *Strategic Management Journal, 13*(4), 287-309.

Rosenberg, S. L., & Cizek, G. J. (2009). *Multilevel validity: Assessing the validity of school-level inferences from student achievement test data*. (Unpublished doctoral dissertation). University of North Carolina at Chapel Hill, Chapel Hill, N.C.

Schefczyk, M. (1993). Operational performance of airlines: an extension of traditional measurement paradigms. *Strategic Management Journal, 14*(4), 301. Retrieved from http://search.proquest.com.ezproxy.libproxy.db.erau.edu/docview/224686317?accountid=27203

Singer, Judith D., Willett, John B. (2003). *Applied longitudinal data analysis : modeling change and event occurrence*. Oxford: Oxford University Press.

Sipika, C., & Smith, D. (1993). From disaster to crisis: the failed turnaround of pan american airlines. *Journal of Contingencies & Crisis Management, 1*(3), 138. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=10479065&site=ehost-live

Smith, B. (2006, May). A painful lesson in politics. *Air Line Pilot*, (5), 18-20.

Smith, M., & Graves, C. (March 01, 2005). Corporate turnaround and financial distress. *Managerial Auditing Journal, 20(* 3), 304-320.

SPSS. (2014). IBM SPSS Software. Retrieved from http://www-01.ibm.com/software/analytics/spss/

Stephenson, W. (1953). *The study of behavior: Q-technique and its methodology.* Chicago: Univ. of Chicago Press.

Sudarsanam, S., & Lai, J. (2001). Corporate financial distress and turnaround strategies: An empirical analysis. *British Journal of Management, 12*(3), 183. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=5304021&site=ehost-live

Tacker, T. (2009). U.S. airline antitrust policy and empty core disequilibrium. *Journal of Private Enterprise, 25*(1), 69-79. Retrieved from http://search.proquest.com.ezproxy.libproxy.db.erau.edu/docview/215107114?accountid=27203

Tan, F. (2008). 30 best practices in analysis of longitudinal data: a multilevel approach. In J. Osborne (Ed.), *Best practices in quantitative methods* (pp. 451-471). Thousand Oaks, CA: SAGE Publications, Inc.

Telser, L.G. 1994. The Usefulness of Core Theory in Economics. *Journal of Economic Perspectives, 8*(2): 151-164.

Tsikriktsis, N. (2007). The effect of operational performance and focus on profitability: a longitudinal study of the U.S. airline industry. *Manufacturing & Service Operations Management, 9*(4), 506.

U.S. Bankruptcy Code, 11U.S.C. § 11

U.S. Electronic Code of Federal Regulations (U.S. ECFR) (2013). Retrieved January 1, 2014, from www.ecfr.gov

U.S. Department of Transportation: Research and Innovative Technology Administration. (2013). Airline employment data - group definition. Retrieved April 29, 2013, from http://www.transtats.bts.gov/employment/

U.S. Department of Transportation: Research and Innovative Technology Administration. (2005). Airline travel since 9/11. *Bureau of Transportation Statistics Issue Brief,* (13) U.S. Government Accountability Office. (2005). *Commercial aviation : Bankruptcy and pension problems are symptoms of underlying structural issues : Report to congressional committees.* Washington, D.C.: U.S. Government Accountability Office.

Vasigh, B., Tacker, T, and Fleming, K. (2008). *Introduction to air transport economics: from theory to applications*. Aldershot, England: Ashgate Pub.

Vasigh, B., Taleghani, R., and Jenkins, D. (2012). *Aircraft finance: Strategies for managing capital costs in a turbulent industry*. Ft. Lauderdale, FL: J. Ross Pub.

Wang, J. E. (2009). *Determinants of profitability and recovery from shocks the case of the U.S. domestic airline industry*. Waterloo, Ont.: University of Waterloo.

Weiss, L. A., & Wruck, K. H. (1996). *Information problems, conflicts of interest and asset stripping : Chapter 11's failure in the case of eastern airlines*. Fontainebleau, France: Insead.

Wensveen, J. G. (2011). *Air transportation: A management perspective*. Aldershot, England: Ashgate.

Xu, M. (2010). *Three essays in chapter 11 bankruptcy post bankruptcy performance, bankrupt stock performance, and relationship with hedge funds and other vulture investors.* (Doctoral dissertation), University of Massachusetts Amherst. Retrieved from Open Access database. (Paper 313)

Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology*, *9*(2), 79-94.

APPENDIX A

Table

Table A1. *Correlations*

	DIP	WC	CJF	DFTE	CEO	WSC	LF	CAP	AFTE	DE	TIME	HAC	DIPC
DIPC	-.247	.077	.150	-.076	-.001	-.039	.070	.249	.000	.034	-.086	-.062	1.000
HAC	-.033	-.113	-.043	-.607	.070	.093	.083	-.028	-.434	.026	-.034	1.000	-.062
TIME	-.059	.137	.086	.060	-.121	.199	-.205	-.153	.227	-.030	1.000	-.034	-.086
DE	-.048	-.018	.007	-.039	.073	-.119	-.020	.058	.021	1.000	-.030	.026	.034
AFTE	-.194	.108	.035	.566	.204	-.133	-.137	-.107	1.000	.021	.227	-.434	.000
CAP	.008	.047	-.059	-.106	-.222	.001	.023	1.000	-.107	.058	-.153	-.028	.249
LF	.110	-.015	.098	.193	-.017	-.052	1.000	.023	-.137	-.020	-.205	.083	.070
WSC	.282	.025	.108	-.002	-.091	1.000	-.052	.001	-.133	-.119	.199	.093	-.039
CEO	-.289	-.077	-.009	.285	1.000	-.091	-.017	-.222	.204	.073	-.121	.070	-.001
DFTE	.105	.018	.044	1.000	.285	-.002	.193	-.106	.566	-.039	.060	-.607	-.076
CJF	.042	.058	1.000	.044	-.009	.108	.098	-.059	.035	.007	.086	-.043	.150
WC	.089	1.000	.058	.018	-.077	.025	-.015	.047	.108	-.018	.137	-.113	.077
DIP	1.000	.089	.042	.105	-.289	.282	.110	.008	-.194	-.048	-.059	-.033	-.247
CNO	-.016	.099	.523	.077	.129	.147	.163	.016	-.077	.068	.060	.034	.142
FLET	-.129	-.177	.138	.102	.231	-.026	.097	-.127	.049	.013	-.097	-.181	.243
CAT	-.108	-.040	-.167	.003	.197	-.424	.152	-.036	-.007	.065	-.020	.069	-.009
MFT	.057	-.033	-.095	-.841	-.305	.091	-.059	.148	-.803	-.002	-.129	.542	.036
CGD	-.101	.131	.048	.179	-.102	-.041	.126	.010	.155	.007	.068	-.098	-.094
NCA	.092	.178	.320	-.142	-.204	.079	-.022	-.020	-.048	-.008	.099	-.119	.380
RAT	-.097	.085	.114	.017	-.096	.285	-.224	.026	.071	-.006	.091	-.190	.027
AAC	.134	-.148	-.028	-.420	-.085	.113	.181	.055	-.934	-.007	-.207	.474	-.025
FTE	.075	.385	-.035	-.044	-.251	.034	-.011	.202	-.010	-.024	.096	.055	-.034
CTIR	.028	-.126	-.584	-.249	.044	-.015	-.243	.041	-.105	-.050	-.115	.143	.009
DEBT	.121	.314	.099	.017	.213	-.059	-.004	-.300	.040	.041	-.031	.026	-.032
MAC	.006	.123	.043	.641	-.046	-.107	-.083	.018	.537	-.021	.058	-.990	.061
ASTS	-.093	-.271	-.327	.123	.123	-.057	.003	.055	.035	-.005	-.059	.117	-.432

Table A1. *Correlations (cont.)*

	ASTS	MAC	DEBT	CTIR	FTE	AAC	RAT	NCA	CGD	MFT	CAT	FLET	CNO
DIPC	-.432	.061	-.032	.009	-.034	-.025	.027	.380	-.094	.036	-.009	.243	.142
HAC	.117	-.990	.026	.143	.055	.474	-.190	-.119	-.098	.542	.069	-.181	.034
TIME	-.059	.058	-.031	-.115	.096	-.207	.091	.099	.068	-.129	-.020	-.097	.060
DE	-.005	-.021	.041	-.050	-.024	-.007	-.006	-.008	.007	-.002	.065	.013	.068
AFTE	.035	.537	.040	-.105	-.010	-.934	.071	-.048	.155	-.803	-.007	.049	-.077
CAP	.055	.018	-.300	.041	.202	.055	.026	-.020	.010	.148	-.036	-.127	.016
LF	.003	-.083	-.004	-.243	-.011	.181	-.224	-.022	.126	-.059	.152	.097	.163
WSC	-.057	-.107	-.059	-.015	.034	.113	.285	.079	-.041	.091	-.424	-.026	.147
CEO	.123	-.046	.213	.044	-.251	-.085	-.096	-.204	-.102	-.305	.197	.231	.129
DFTE	.123	.641	.017	-.249	-.044	-.420	.017	-.142	.179	-.841	.003	.102	.077
CJF	-.327	.043	.099	-.584	-.035	-.028	.114	.320	.048	-.095	-.167	.138	.523
WC	-.271	.123	.314	-.126	.385	-.148	.085	.178	.131	-.033	-.040	-.177	.099
DIP	-.093	.006	.121	.028	.075	.134	-.097	.092	-.101	.057	-.108	-.129	-.016
CNO	-.260	-.023	.124	-.315	-.031	.028	.021	.228	-.207	.090	-.021	.186	1.000
FLET	-.248	.184	.126	.010	-.858	-.035	-.174	.216	-.164	-.188	.144	1.000	.186
CAT	.100	-.065	.009	.207	-.144	.033	-.856	-.103	-.204	.031	1.000	.144	-.021
MFT	-.081	-.610	-.052	.227	.160	.646	-.019	.102	-.235	1.000	.031	-.188	.090
CGD	.247	.120	-.230	-.752	.254	-.087	.233	-.225	1.000	-.235	-.204	-.164	-.207
NCA	-.950	.111	.177	.044	.012	-.037	.074	1.000	-.225	.102	-.103	.216	.228
RAT	-.073	.179	-.016	-.287	.175	-.054	1.000	.074	.233	-.019	-.856	-.174	.021
AAC	.047	-.577	-.043	.025	-.027	1.000	-.054	-.037	-.087	.646	.033	-.035	.028
FTE	.011	-.055	-.179	-.114	1.000	-.027	.175	.012	.254	.160	-.144	-.858	-.031
CTIR	-.049	-.151	.089	1.000	-.114	.025	-.287	.044	-.752	.227	.207	.010	-.315
DEBT	-.440	-.020	1.000	.089	-.179	-.043	-.016	.177	-.230	-.052	.009	.126	.124
MAC	-.111	1.000	-.020	-.151	-.055	-.577	.179	.111	.120	-.610	-.065	.184	-.023
ASTS	1.000	-.111	-.440	-.049	.011	.047	-.073	-.950	.247	-.081	.100	-.248	-.260

APPENDIX B

Air Carrier Data

Table B1. *Data Removed due to Listwise Deletion.*

Training Data Set	Air Carriers Removed due to Listwise Deletion	Number of Air Carriers used for MLM	Valid Cases	Excluded Cases	Total Cases
L1	ATL, TWA1	18	196	64	260
L2	ATL, TWA1	18	212	48	260
L3	ATL, TWA1	18	197	63	260
L4	TWA1	19	213	47	260
L5	ATL	19	214	46	260

Table C2. *Air Carrier Specific Data Collection Issues.*

Air Carrier	Year	Quarter	Data	Issue
Allegiant Air	2002 - 2003	1-4	All	Due to air carrier size, Allegiant was considered a small carrier for part of the data collection period. Biannual measurements were divided in half to calculate quarterly income statement values. Q2 and Q4 Balance sheet values were used for the quarter prior's values due the biannual measurement period.
Aloha Airlines	2008	1	Aircraft Operated	Value not reported to DOT. The previous quarters value was used.
Aloha Airlines			CEO	The CEO was replaced prior to the quarter filing bankruptcy.
ATA Airlines	2004	4	Aircraft Operated	No values reported to DOT for 2004. 2003 count was used for pre-bankruptcy value.
ATA Airlines	2007	1-4	Aircraft Operated	No values reported to DOT for 2007. 2006 count was used.
Atlas Air/Polar Air Cargo	2004	1	Aircraft Operated	2003 Q4 value was used as it was more accurate than the 2004 Q1 value which included two months of changes in bankruptcy.
America West Airlines	1991	2	Aircraft Operated	Value not reported to DOT and unable to find. Value remains missing.
Braniff International	1982	2	Employees	Value not reported to DOT; 1981 value used.
Braniff International			Financial	1983 (Q3, Q4) 1984 (Q1) not reported to DOT. Post-bankruptcy data began with data 4 quarters after emerging.
Continental Airlines 1	1983	3	Aircraft Operated	Value not reported to DOT and unable to find. Value remains missing.
Continental Airlines 1	1983	3	Employees	Value not reported to DOT; 1982 value used.

Hawaiian Airlines 1			CEO	The CEO was replaced prior to the quarter filing bankruptcy.
Markair	1992	2	Aircraft Operated	Value not reported to DOT and unable to find. Value remains missing.
Mesa Air	2013	1	Aircraft Operated	No values reported to DOT. 2012 Q4 count was used.
Sun Country 1	2002	3	Employees	No values reported to DOT. Value interpolated on quarters before and after.
Sun Country Airlines 2			CEO	The CEO was replaced prior to the quarter filing bankruptcy.
Sun Country Airlines 2	2013	1	Aircraft Operated	No values reported to DOT. 2012 Q4 count was used.
Trans World Airlines 1	1993-1995	1-4	Aircraft Operated	Value not reported to DOT and unable to find. Value remains missing.
Trans World Airlines 2			CEO	The CEO was replaced prior to the quarter filing bankruptcy.
United Airlines	2008	4	Retained Earnings	DOT Form 41 data says 11,001,432 and is incorrect based on Balance Sheet analysis. 2008 annual report says 5,199,000. Replaced with 5,199,000.
US Airways 1			CEO	The CEO was replaced prior to the quarter filing bankruptcy.
US Airways 2			CEO	The CEO was replaced prior to the quarter filing bankruptcy.

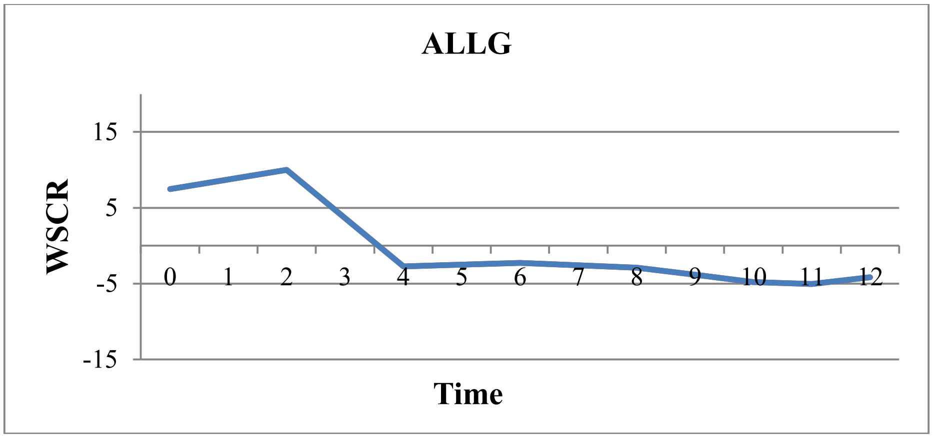
APPENDIX C

Air Carrier W-Score, P-Score and Restructuring Strategy

C23 United Airlines

C24 US Airways 1st Bankruptcy

C25 US Airways 2nd Bankruptcy



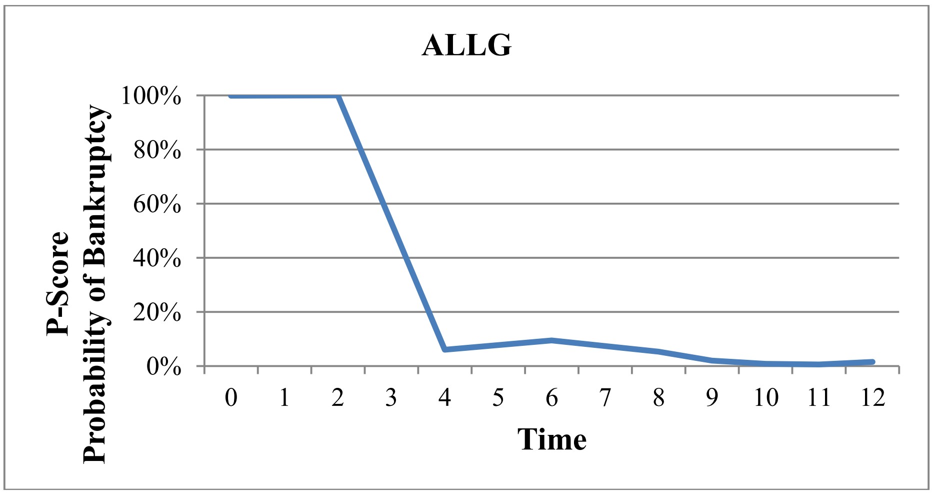


Figure C1. Allegiant Air W-Score and P-Score.

Table C1. *Allegiant Air Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	4,620	64,005	+1285%
CATM	1.19	0.77	-35%
DEBT	14,677	56,227	+283%
DIP	0	0	No DIP
AAC	1,113,354	3,155,953	+183%
TIME	0	12	N/A
WSCR	7.46	-4.15	
P-Score	99.94%	1.55%	-98.40 pts.

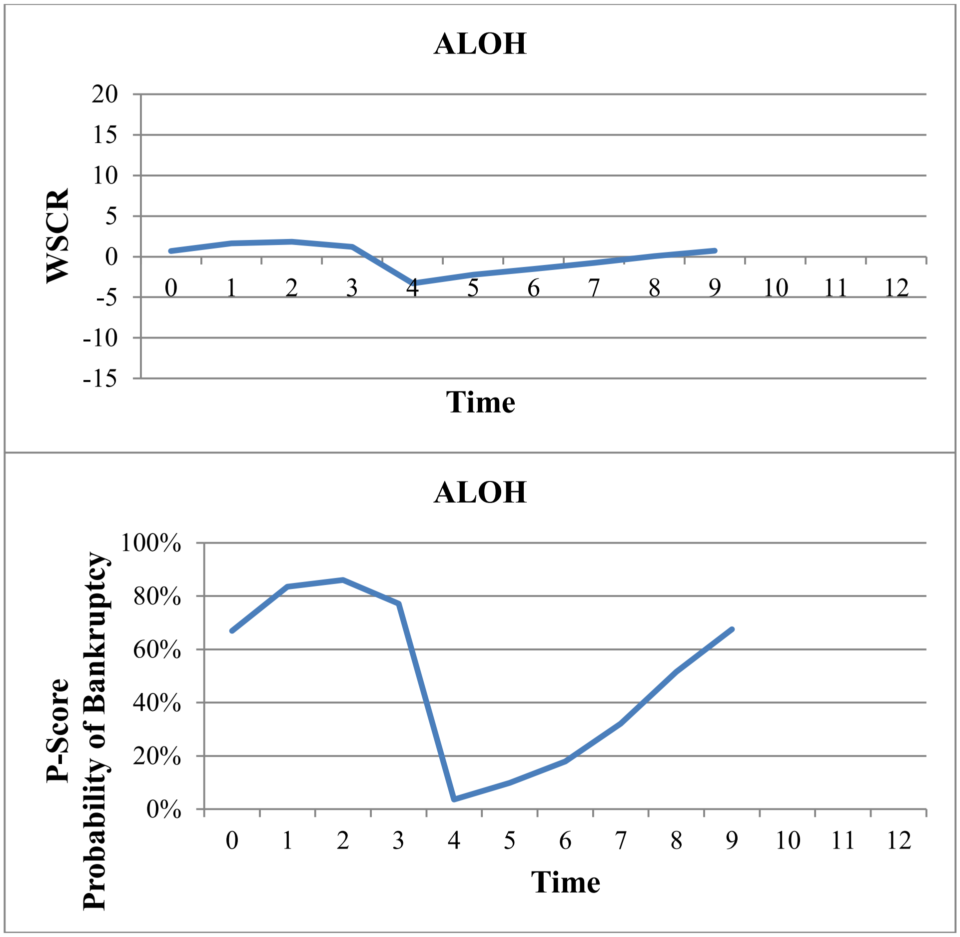


Figure C2. Aloha Airlines W-Score and P-Score.

Table C2. *Aloha Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	152,833	216,951	+42%
CATM	1.02	1.32	+30%
DEBT	305,302	304,152	-0%
DIP	0	1	Yes DIP
AAC	3,594,859	3,491,081	-3%
TIME	0	9	N/A
WSCR	0.70	0.73	
P-Score	66.88%	67.53%	0.66 pts.

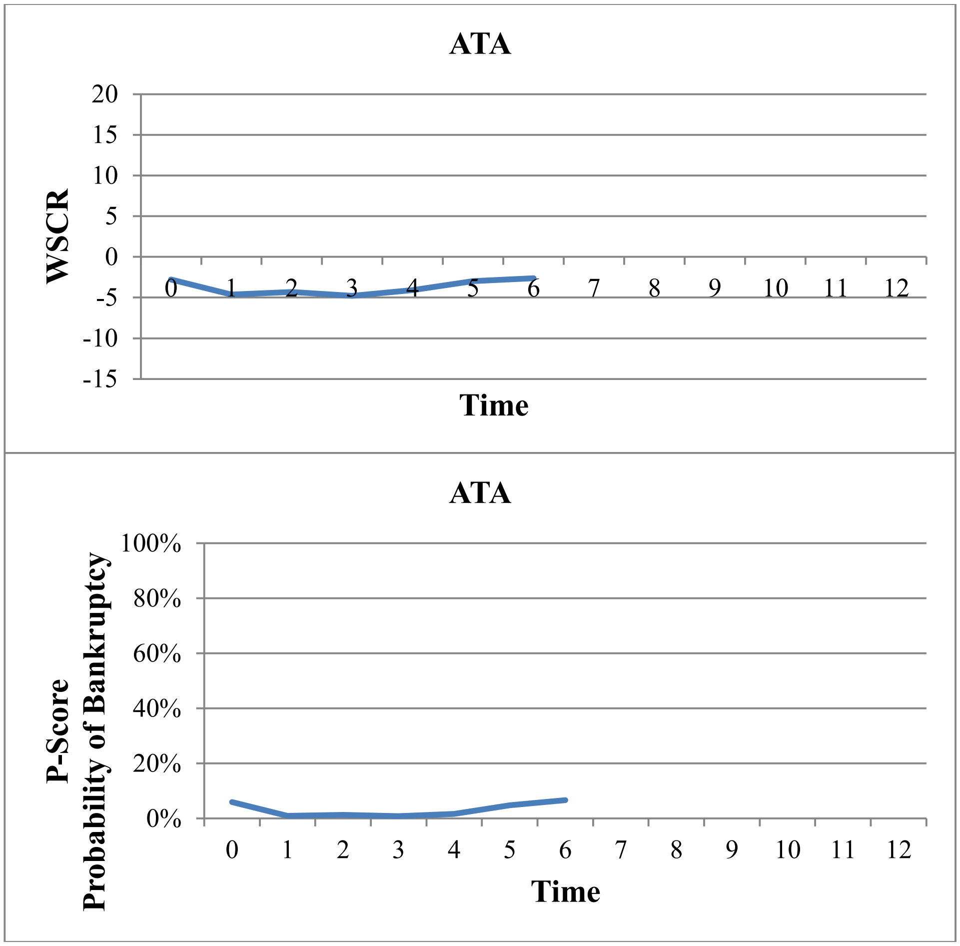


Figure C3. ATA Airlines W-Score and P-Score.

Table C3. *ATA Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	318,375	404,984	+27%
CATM	1.31	0.68	-48%
DEBT	580,549	377,746	-35%
DIP	0	1	Yes DIP
AAC	9,164,796	47,035,114	+413%
TIME	0	6	N/A
WSCR	-2.76	-2.64	
P-Score	5.93%	6.67%	0.73 pts.

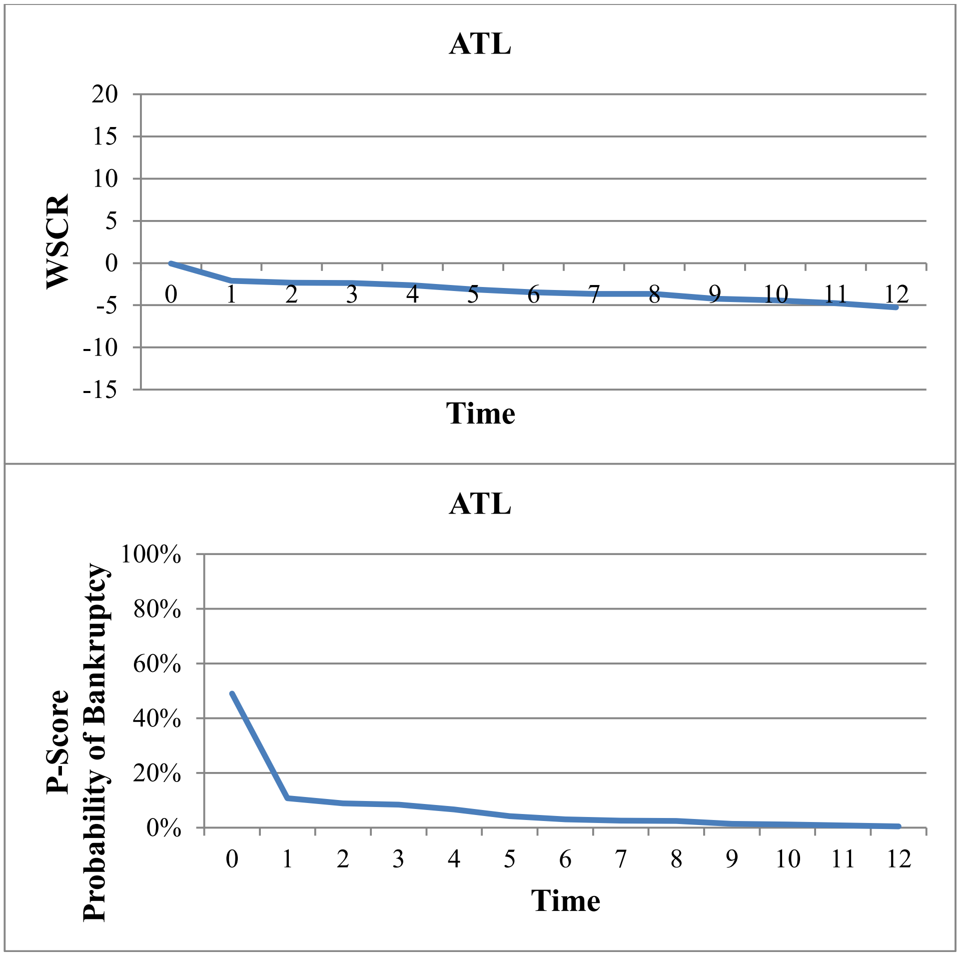


Figure C4. Atlas Air/Polar Air Cargo W-Score and P-Score.

Table C4. *Atlas Air/Polar Air Cargo Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	1,436,383	887,183	-38%
CATM	0.15	0.14	-3%
DEBT	1,461,905	570,508	-61%
DIP	0	1	Yes DIP
AAC	31,190,775	72,633,430	+133%
TIME	0	12	N/A
WSCR	-0.04	-5.26	
P-Score	48.97%	0.52%	-48.45 pts.

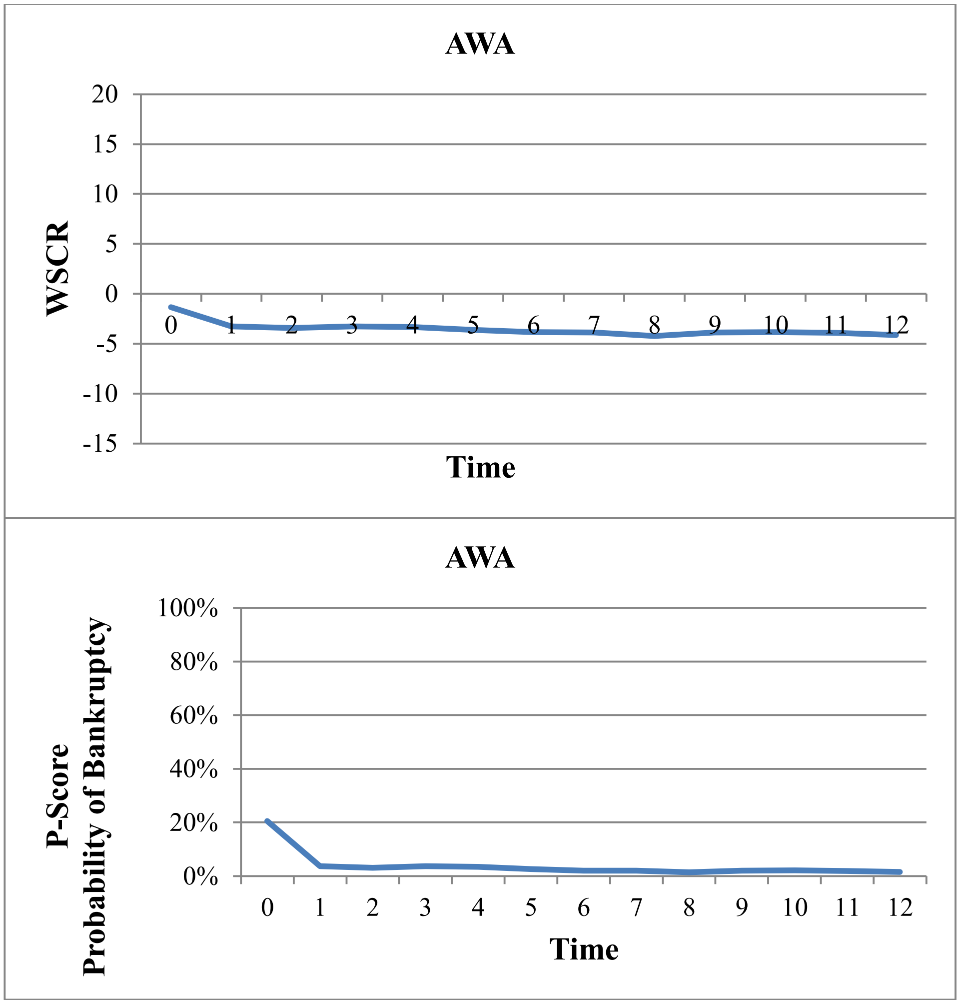


Figure C5. America West Airlines W-Score and P-Score.

Table C5. *America West Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	1,230,116	1,583,725	+29%
CATM	0.58	0.59	+1%
DEBT	1,250,532	937,347	-25%
DIP	0	1	Yes DIP
AAC	missing	7,189,374	N/A
TIME	0	12	N/A
WSCR	-1.35	-4.12	
P-Score	20.56%	1.60%	-18.96 pts.

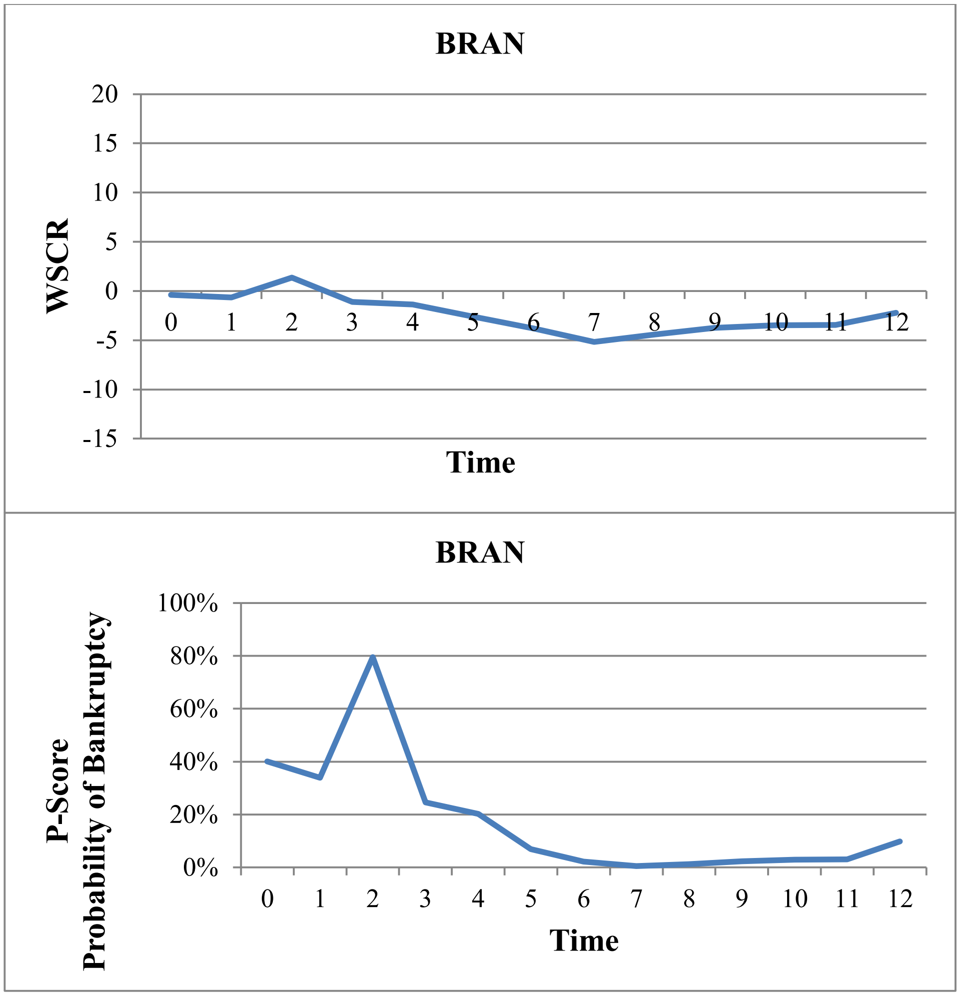


Figure C6. Braniff International W-Score and P-Score.

Table C6. *Braniff International Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	877,546	93,678	-89%
CATM	0.29	0.22	-25%
DEBT	910,637	56,303	-94%
DIP	0	0	No DIP
AAC	7,303,934	12,786,541	+75%
TIME	0	12	N/A
WSCR	-0.40	-2.21	
P-Score	40.08%	9.85%	-30.23 pts.

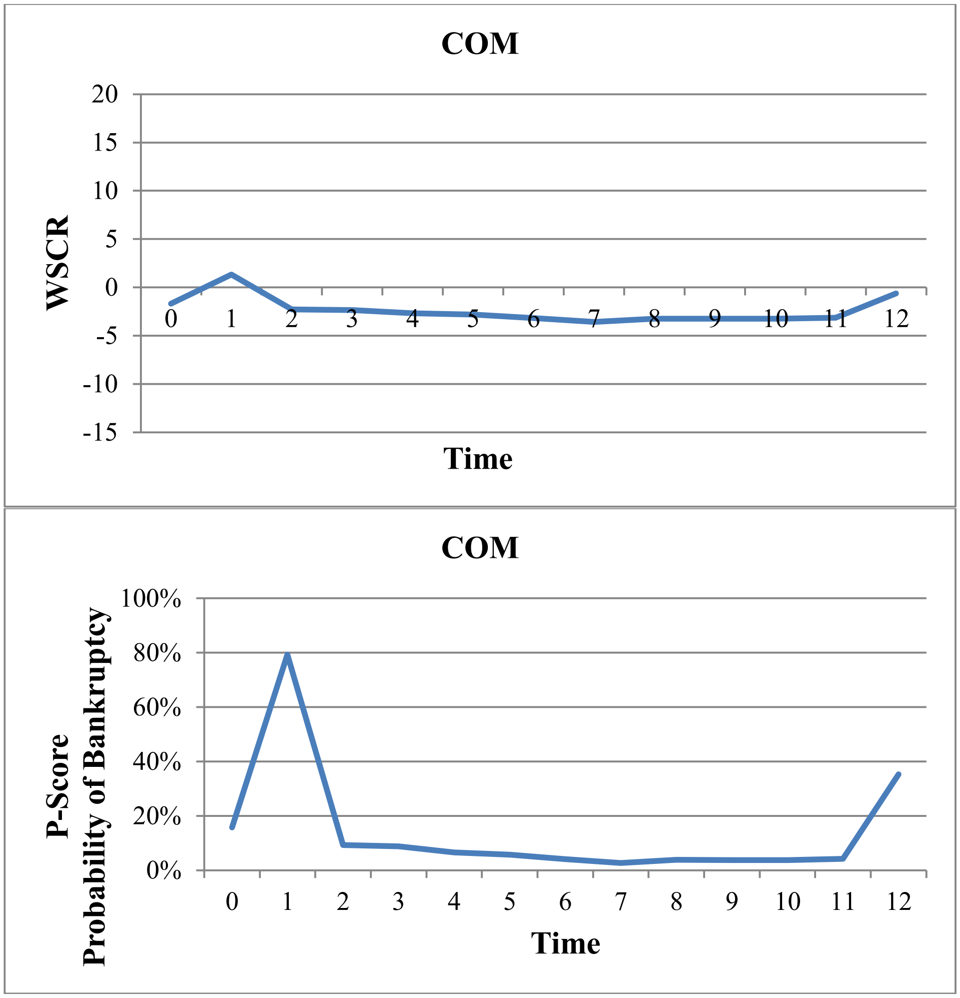


Figure C7. Comair W-Score and P-Score.

Table C7. *Comair Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	2,391,313	945,320	-60%
CATM	1.13	0.78	-30%
DEBT	1,596,267	763,835	-52%
DIP	0	1	Yes DIP
AAC	1,812,075	1,200,116	-34%
TIME	0	12	N/A
WSCR	-1.68	-0.61	
P-Score	15.68%	35.26%	19.58 pts.

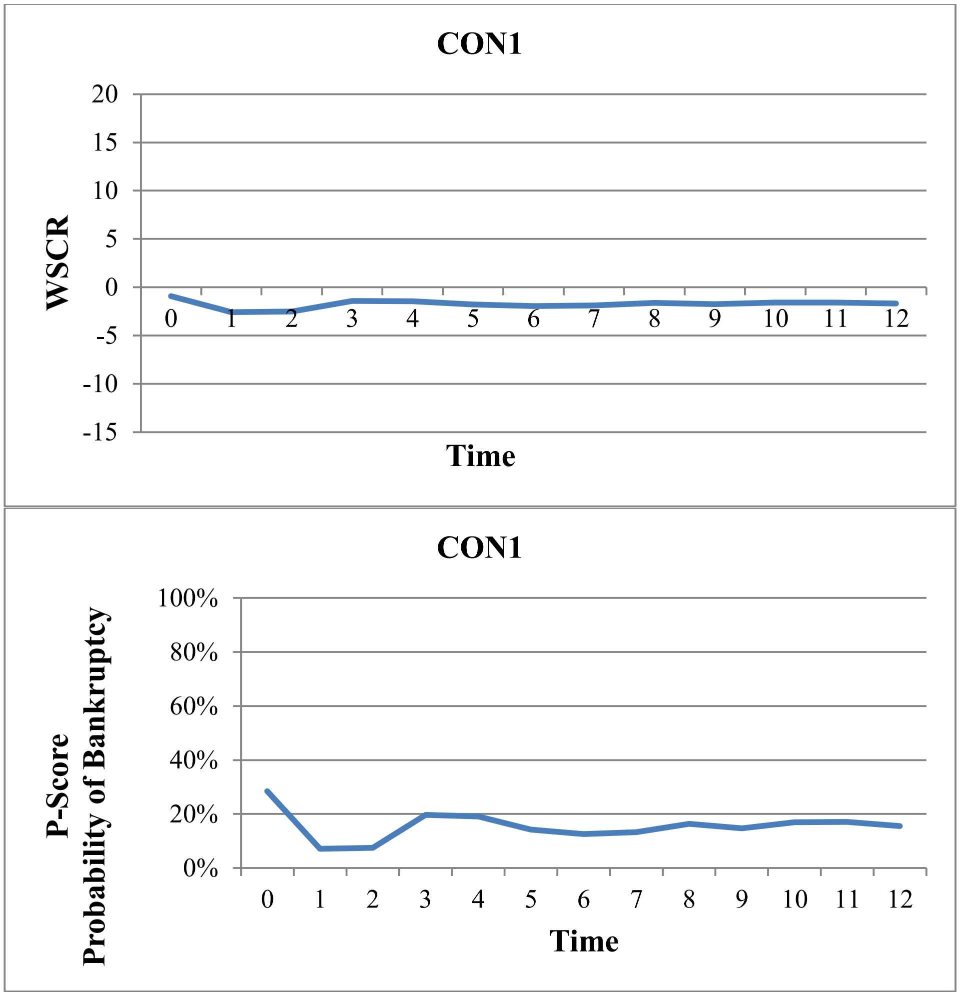


Figure C8. Continental Airlines 1st Bankruptcy W-Score and P-Score.

Table C8. *Continental Airlines 1st Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	1,110,287	4,016,479	+262%
CATM	0.31	0.26	-14%
DEBT	1,158,120	3,903,210	+237%
DIP	0	0	No DIP
AAC	missing	13,881,224	N/A
TIME	0	12	N/A
WSCR	-0.92	-1.69	
P-Score	28.44%	15.55%	-12.89 pts.

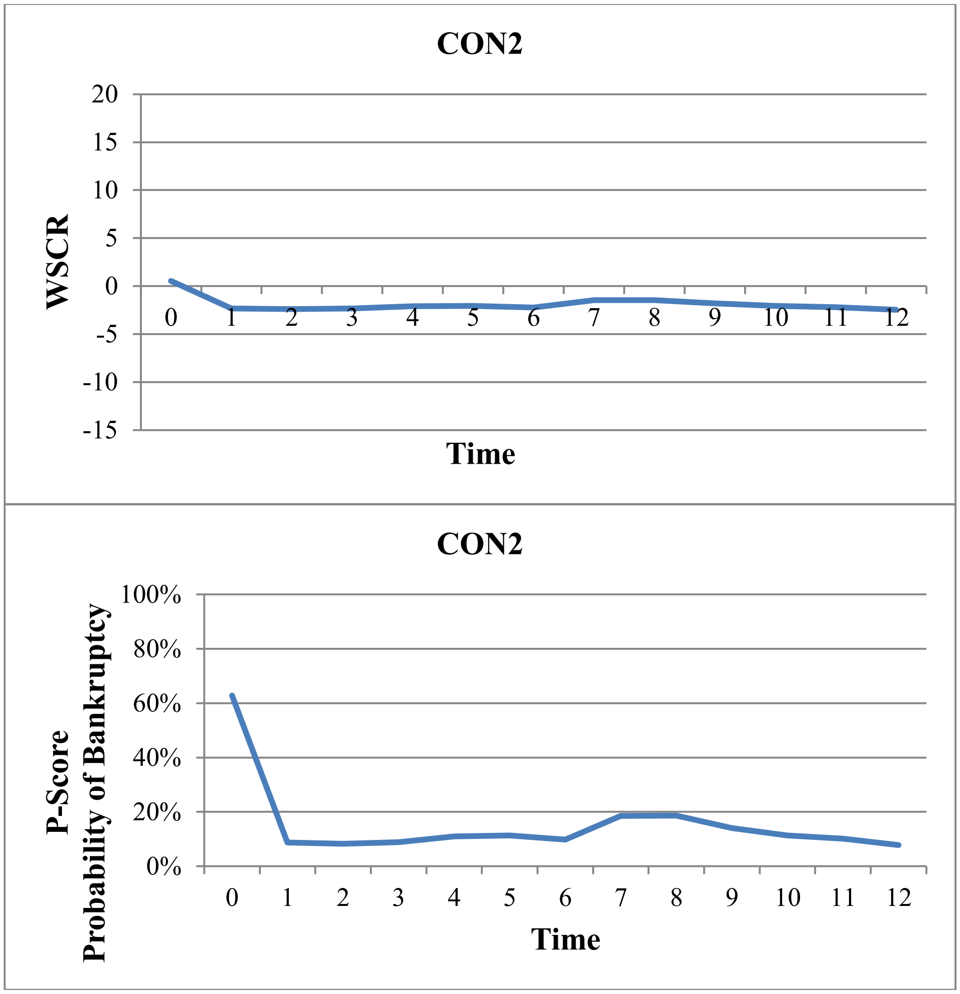


Figure C9. Continental Airlines 2nd Bankruptcy W-Score and P-Score.

Table C9. *Continental Airlines 2nd Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	3,091,744	4,084,843	+32%
CATM	0.66	0.76	+14%
DEBT	4,816,897	3,694,403	-23%
DIP	0	1	Yes DIP
AAC	7,026,434	5,298,656	-25%
TIME	0	12	N/A
WSCR	0.53	-2.48	
P-Score	62.85%	7.76%	-55.10 pts.

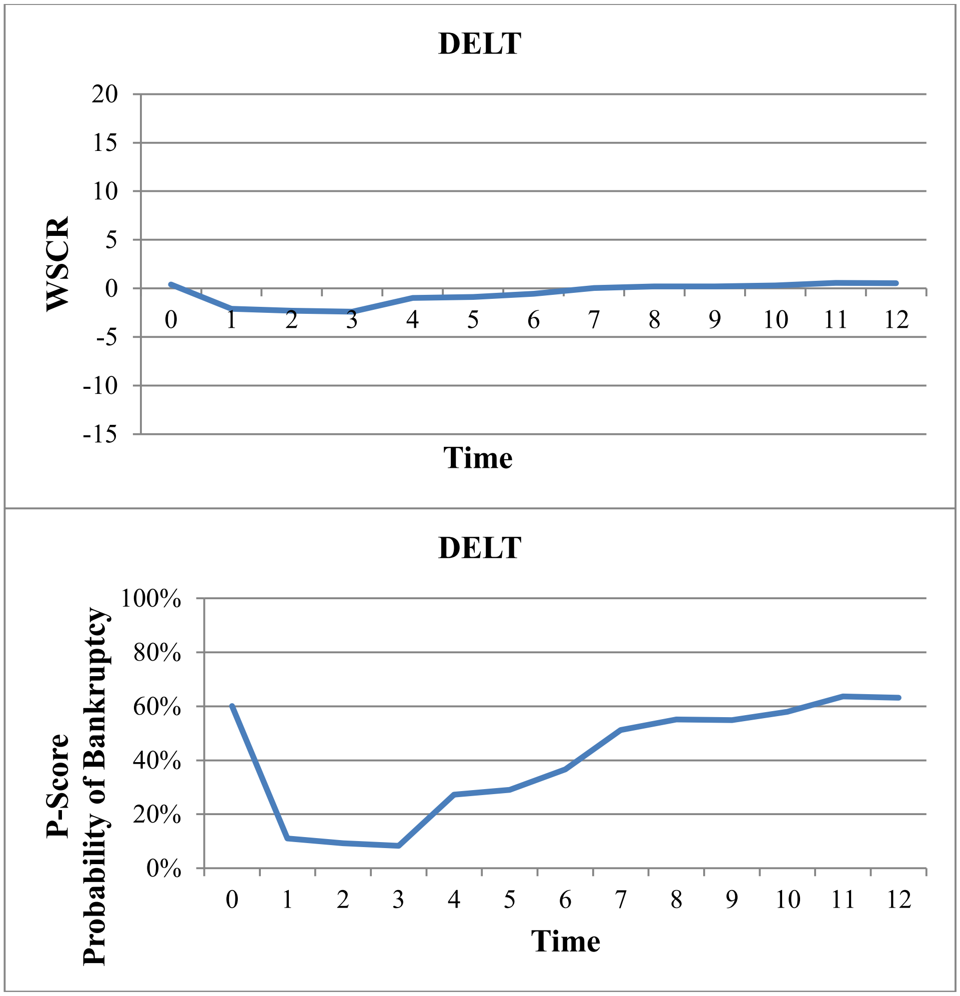


Figure C10. Delta Airlines W-Score and P-Score.

Table C10. *Delta Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	19,587,128	44,018,556	+125%
CATM	0.82	1.00	+21%
DEBT	24,075,103	44,173,320	+83%
DIP	0	1	Yes DIP
AAC	10,797,507	9,128,322	-15%
TIME	0	12	N/A
WSCR	0.41	0.54	
P-Score	60.08%	63.15%	3.08 pts.

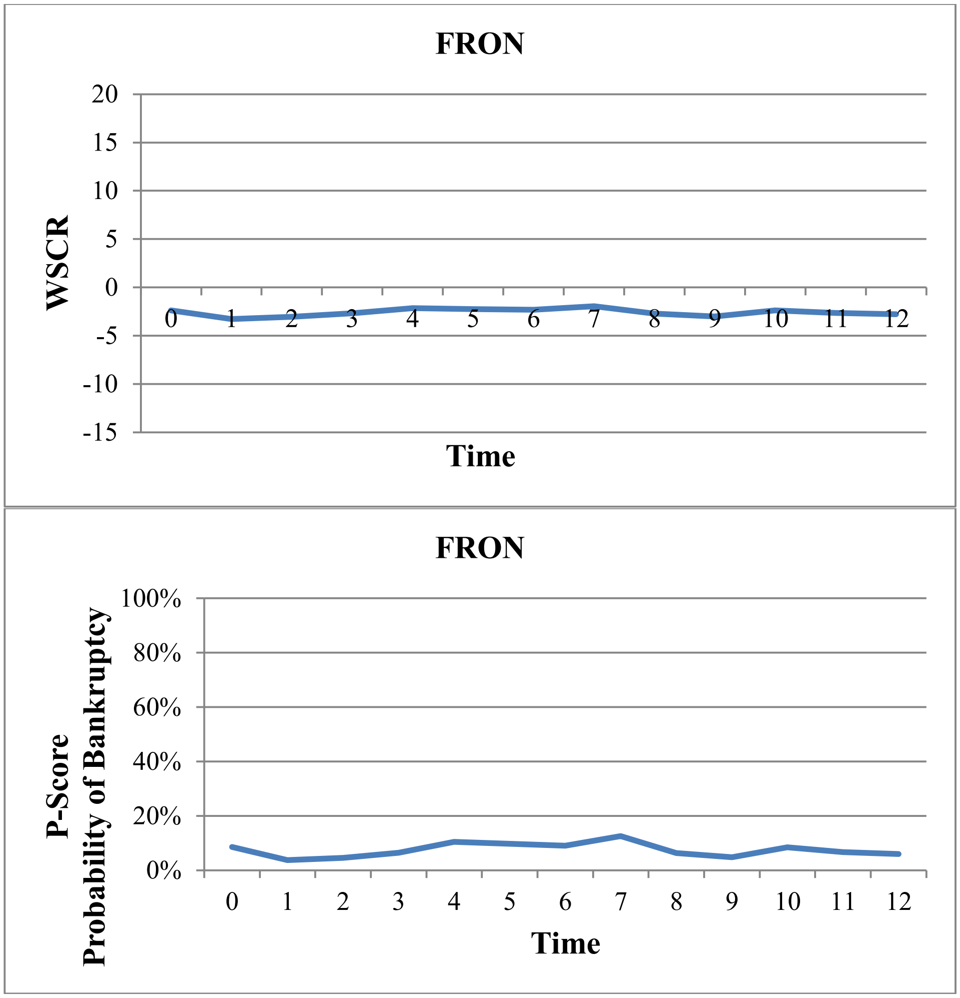


Figure C11. Frontier Airlines W-Score and P-Score.

Table C11. *Frontier Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	1,088,225	850,555	-22%
CATM	1.00	1.00	-0%
DEBT	982,035	734,089	-25%
DIP	0	1	Yes DIP
AAC	7,933,165	6,267,818	-21%
TIME	0	12	N/A
WSCR	-2.37	-2.76	
P-Score	8.59%	5.93%	-2.65 pts.

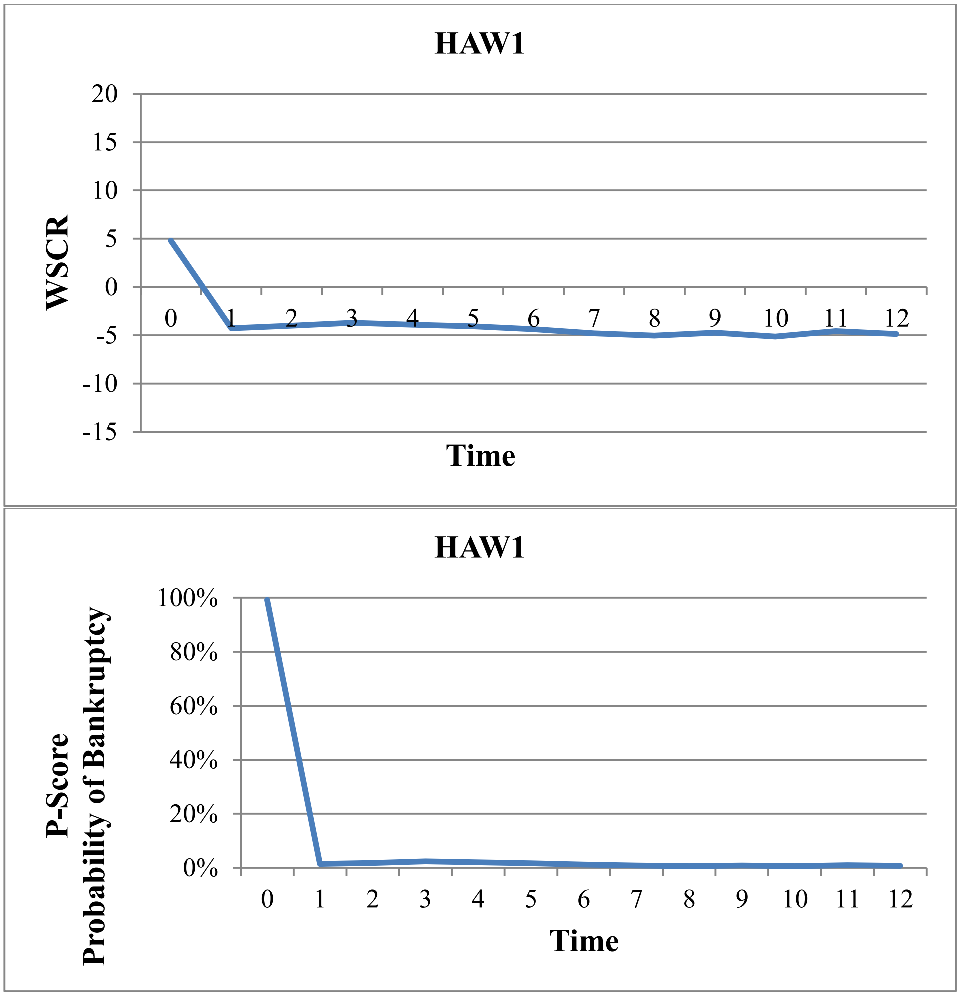


Figure C12. Hawaiian Airlines 1st Bankruptcy W-Score and P-Score.

Table C12. *Hawaiian Airlines 1st Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	119,475	208,502	+75%
CATM	0.66	0.52	-21%
DEBT	306,522	124,863	-59%
DIP	0	0	No DIP
AAC	6,321,696	8,892,015	+41%
TIME	0	12	N/A
WSCR	4.81	-4.87	
P-Score	99.19%	0.76%	-98.43 pts.

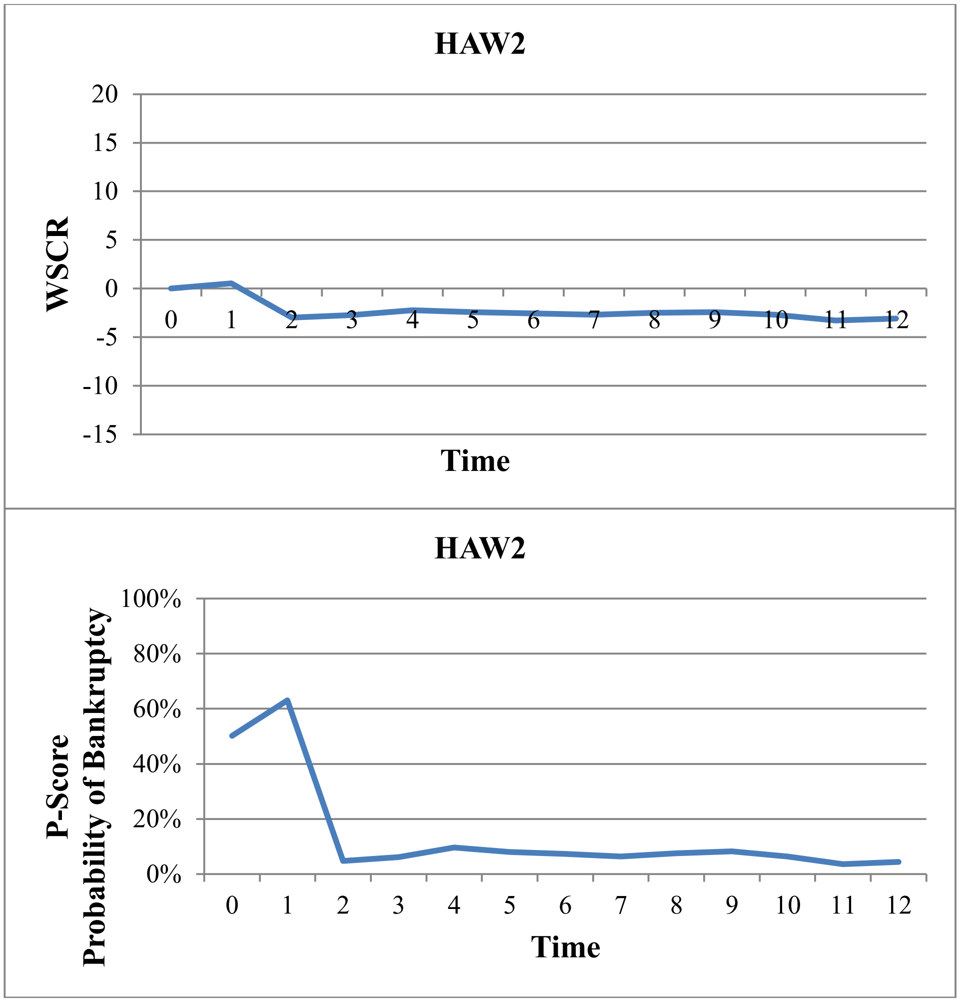


Figure C13. Hawaiian Airlines 2nd Bankruptcy W-Score and P-Score.

Table C13. *Hawaiian Airlines 2nd Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	240,105	848,712	+253%
CATM	0.58	0.72	+23%
DEBT	398,860	810,069	+103%
DIP	0	0	No DIP
AAC	11,223,578	11,467,651	+2%
TIME	0	12	N/A
WSCR	0.01	-3.09	
P-Score	50.13%	4.34%	-45.80 pts.

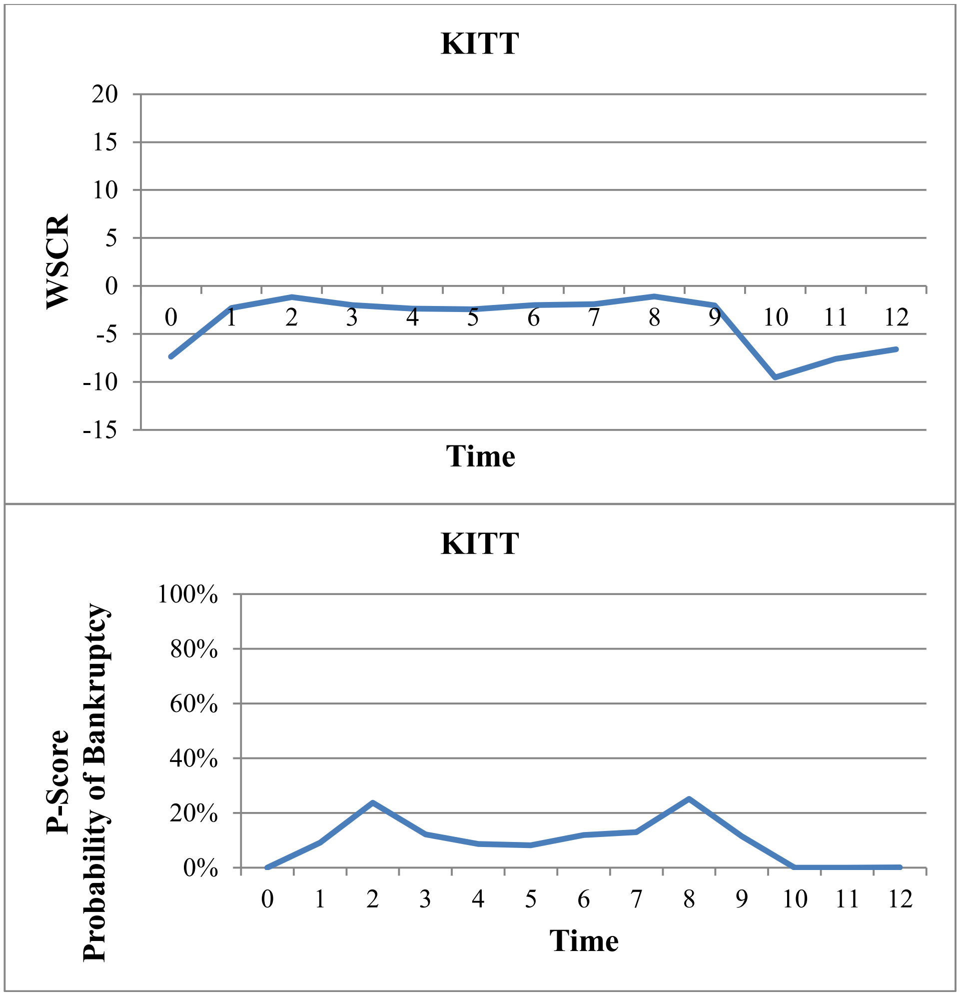


Figure C14. Kitty Hawk W-Score and P-Score.

Table C14. *Kitty Hawk Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	181,878	7,582	-96%
CATM	0.45	0.03	-94%
DEBT	98,428	4,309	-96%
DIP	0	0	No DIP
AAC	2,724,087	1,881,754	-31%
TIME	0	12	N/A
WSCR	-7.38	-6.60	
P-Score	0.06%	0.14%	0.07 pts.

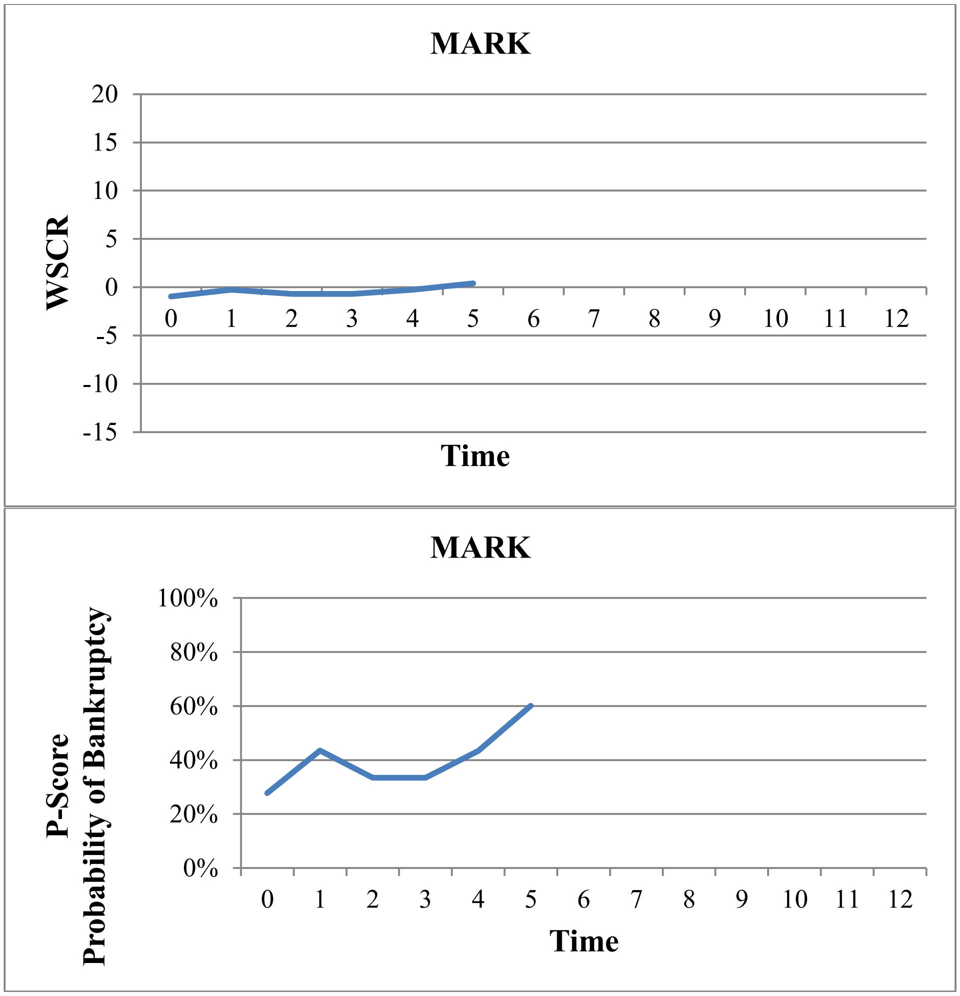


Figure C15. Markair W-Score and P-Score.

Table C15. *Markair Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	205,980	150,600	-27%
CATM	0.59	0.67	+13%
DEBT	201,203	222,219	+10%
DIP	0	0	No DIP
AAC	missing	7,822,636	N/A
TIME	0	5	N/A
WSCR	-0.96	0.41	
P-Score	27.78%	60.14%	32.36 pts.

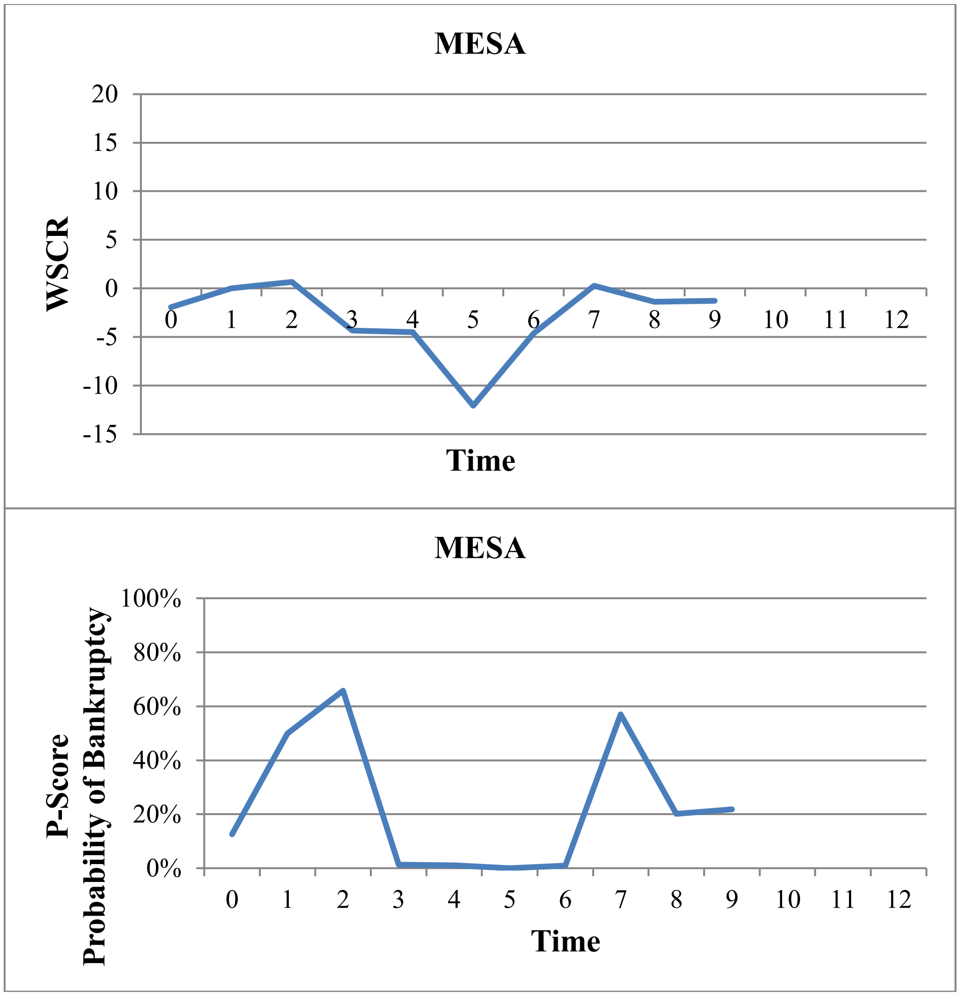


Figure C16. Mesa Air W-Score and P-Score.

Table C16. *Mesa Air Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	1,233,140	748,187	-39%
CATM	1.04	0.65	-38%
DEBT	1,011,178	739,909	-27%
DIP	0	0	No DIP
AAC	2,311,618	1,731,746	-25%
TIME	0	9	N/A
WSCR	-1.94	-1.28	
P-Score	12.62%	21.76%	9.15 pts.

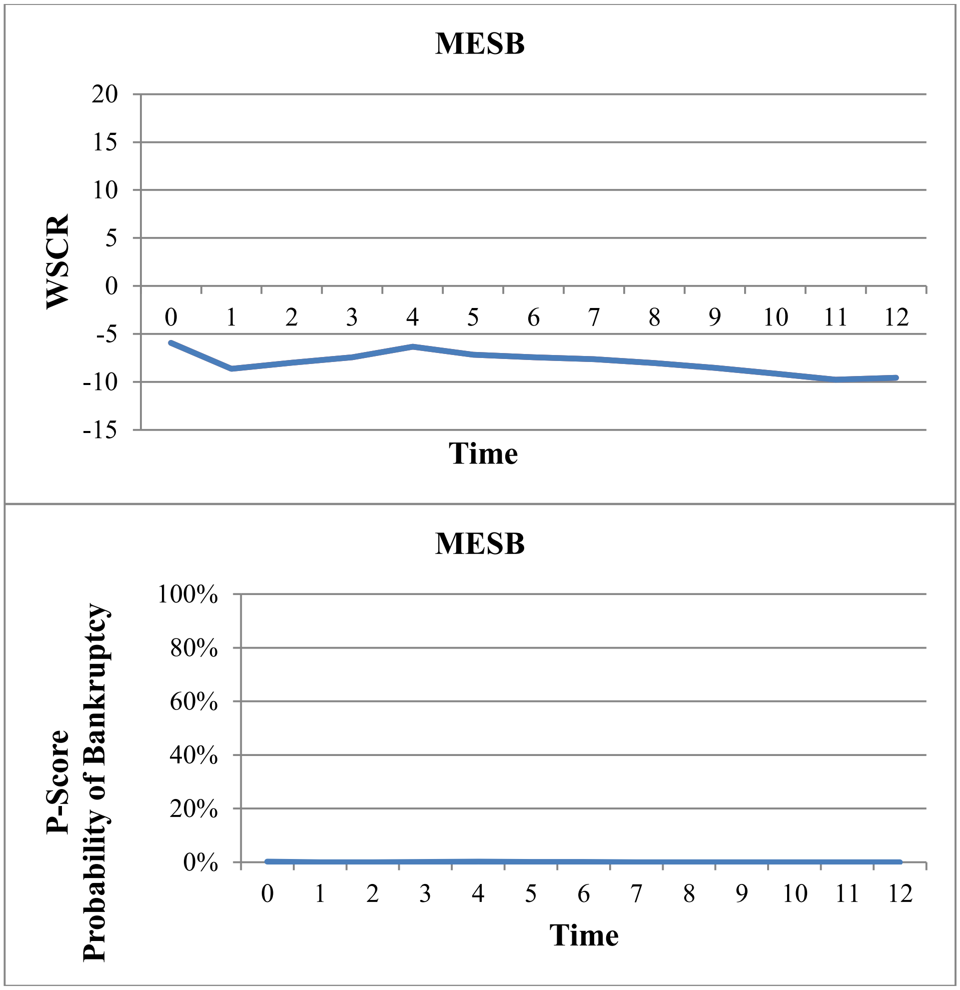


Figure C17. Mesaba Airlines W-Score and P-Score.

Table C17. *Mesaba Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	151,955	121,341	-20%
CATM	1.09	0.55	-49%
DEBT	103,426	66,792	-35%
DIP	0	1	Yes DIP
AAC	920,055	1,782,318	+94%
TIME	0	12	N/A
WSCR	-5.93	-9.56	
P-Score	0.26%	0.01%	-0.26 pts.

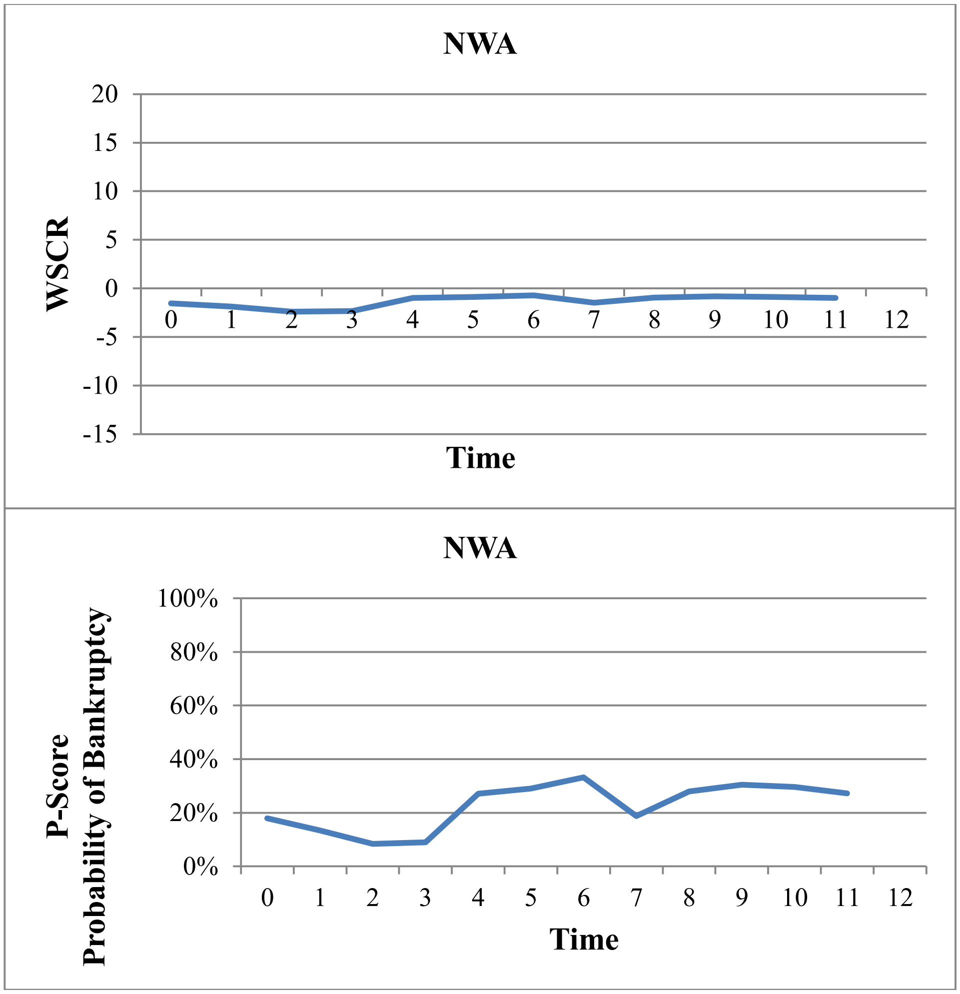


Figure C18. Northwest Airlines W-Score and P-Score.

Table C18. *Northwest Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	18,706,101	19,289,102	+3%
CATM	0.89	0.98	+10%
DEBT	17,412,776	17,187,256	-1%
DIP	0	1	Yes DIP
AAC	10,390,157	9,069,580	-13%
TIME	0	11	N/A
WSCR	-1.52	-0.98	
P-Score	17.92%	27.29%	9.37 pts.

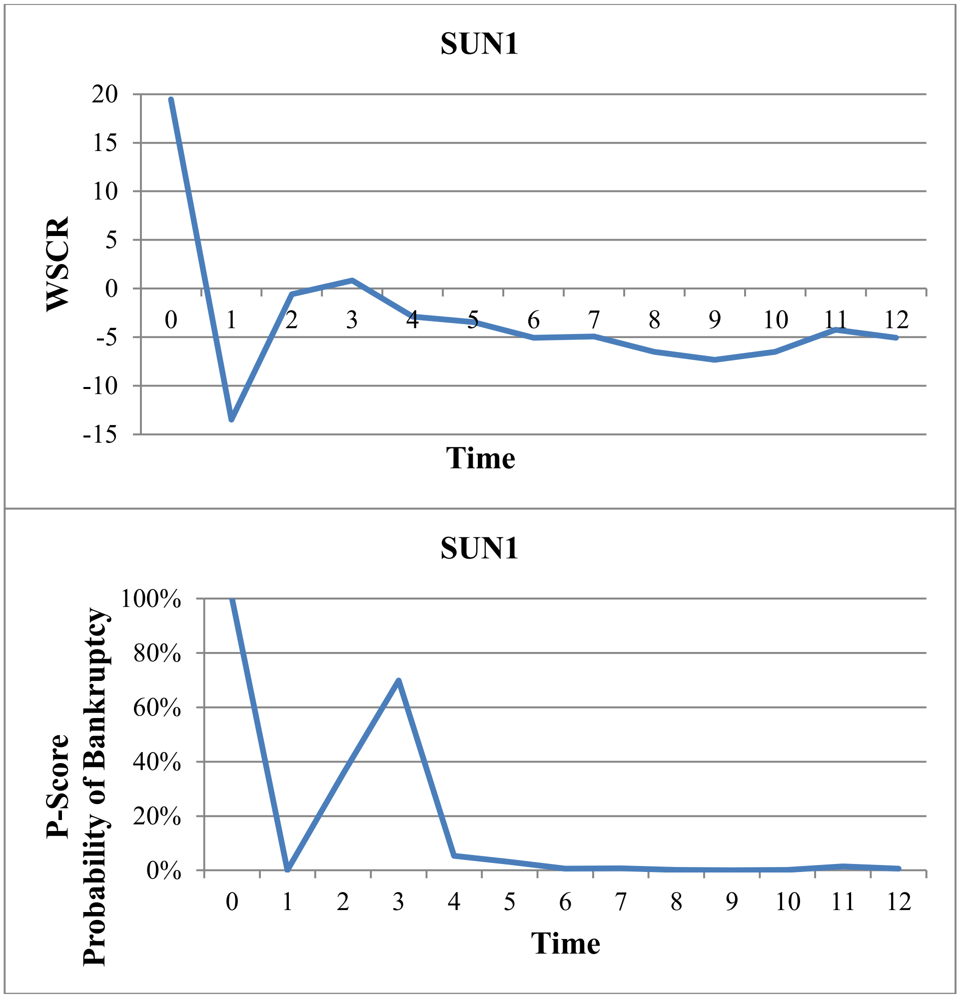


Figure C19. Sun Country 1st Bankruptcy W-Score and P-Score.

Table C19. *Sun Country 1st Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	16,526	62,720	+280%
CATM	2.09	0.53	-74%
DEBT	169,326	54,387	-68%
DIP	0	1	Yes DIP
AAC	6,042,941	9,497,791	+57%
TIME	0	12	N/A
WSCR	19.46	-5.05	
P-Score	100.00%	0.64%	-99.36 pts.

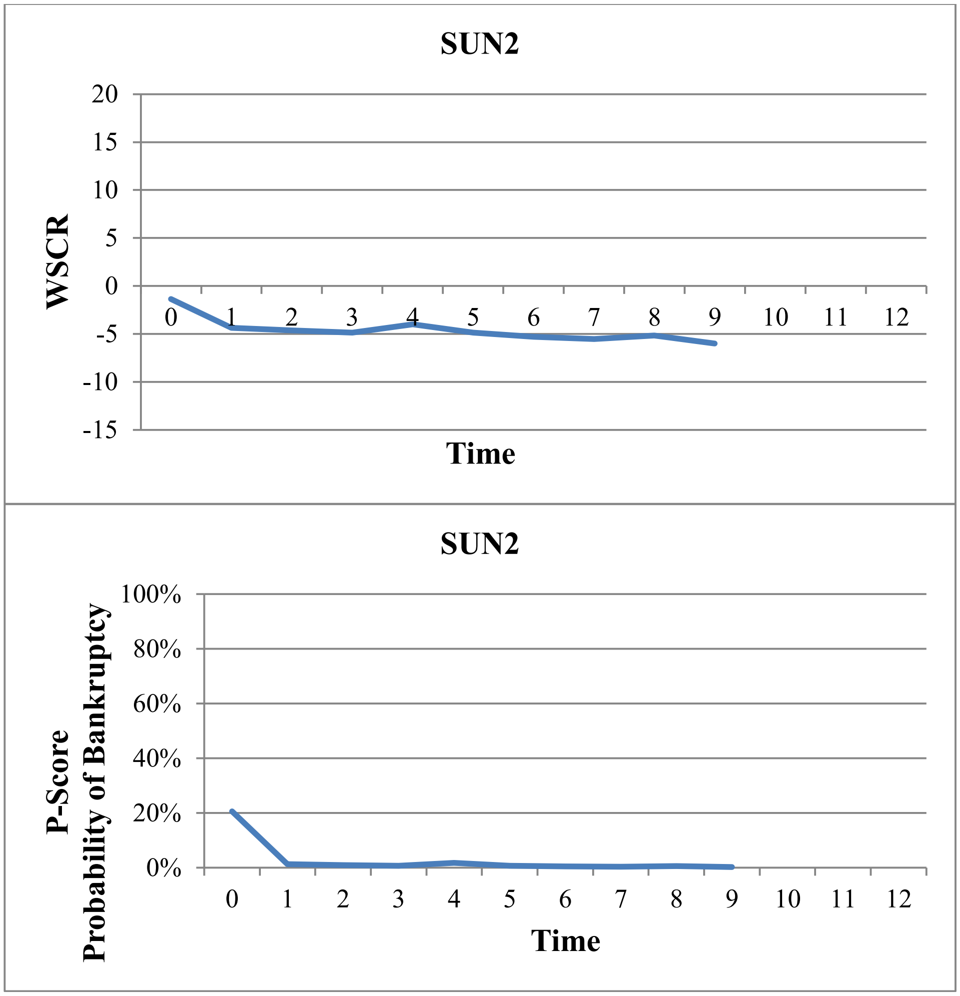


Figure C20. Sun Country Airlines 2nd Bankruptcy W-Score and P-Score.

Table C20. *Sun Country Airlines 2nd Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	100,681	158,406	+57%
CATM	0.66	0.85	+29%
DEBT	135,554	88,237	-35%
DIP	0	1	Yes DIP
AAC	7,204,056	7,348,311	+2%
TIME	0	9	N/A
WSCR	-1.35	-5.99	
P-Score	20.56%	0.25%	-20.31 pts.

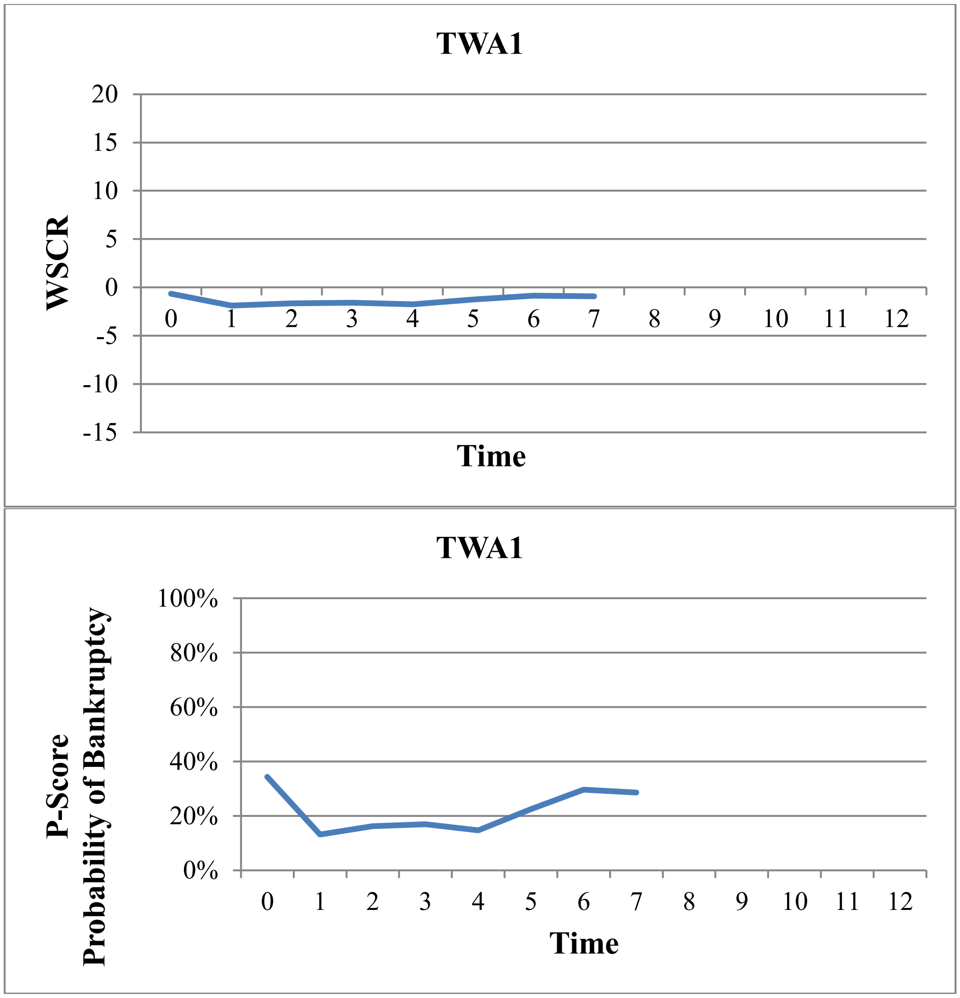


Figure C21. Trans World Airlines 1st Bankruptcy W-Score and P-Score.

Table C21. *Trans World Airlines 1st Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	2,749,093	2,554,535	-7%
CATM	0.67	0.61	-8%
DEBT	3,633,754	3,089,638	-15%
DIP	0	1	Yes DIP
AAC	39,315,318	missing	N/A
TIME	0	7	N/A
WSCR	-0.65	-0.92	
P-Score	34.30%	28.55%	-5.75 pts.

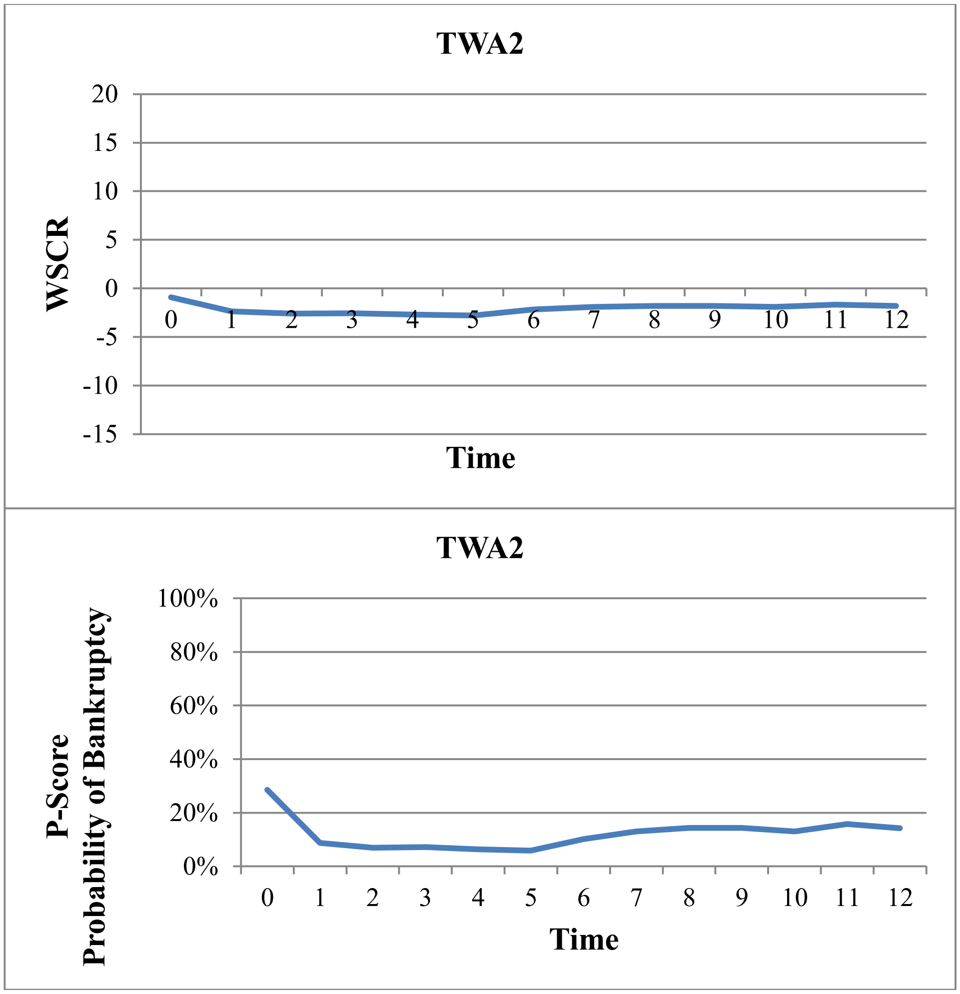


Figure C22. Trans World Airlines 2nd Bankruptcy W-Score and P-Score.

Table C22. *Trans World Airlines 2nd Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	2,554,535	2,928,670	+15%
CATM	0.61	0.68	+12%
DEBT	3,089,638	2,707,383	-12%
DIP	0	0	No DIP
AAC	6,551,698	5,883,974	-10%
TIME	0	12	N/A
WSCR	-0.92	-1.79	
P-Score	28.55%	14.26%	-14.29 pts.

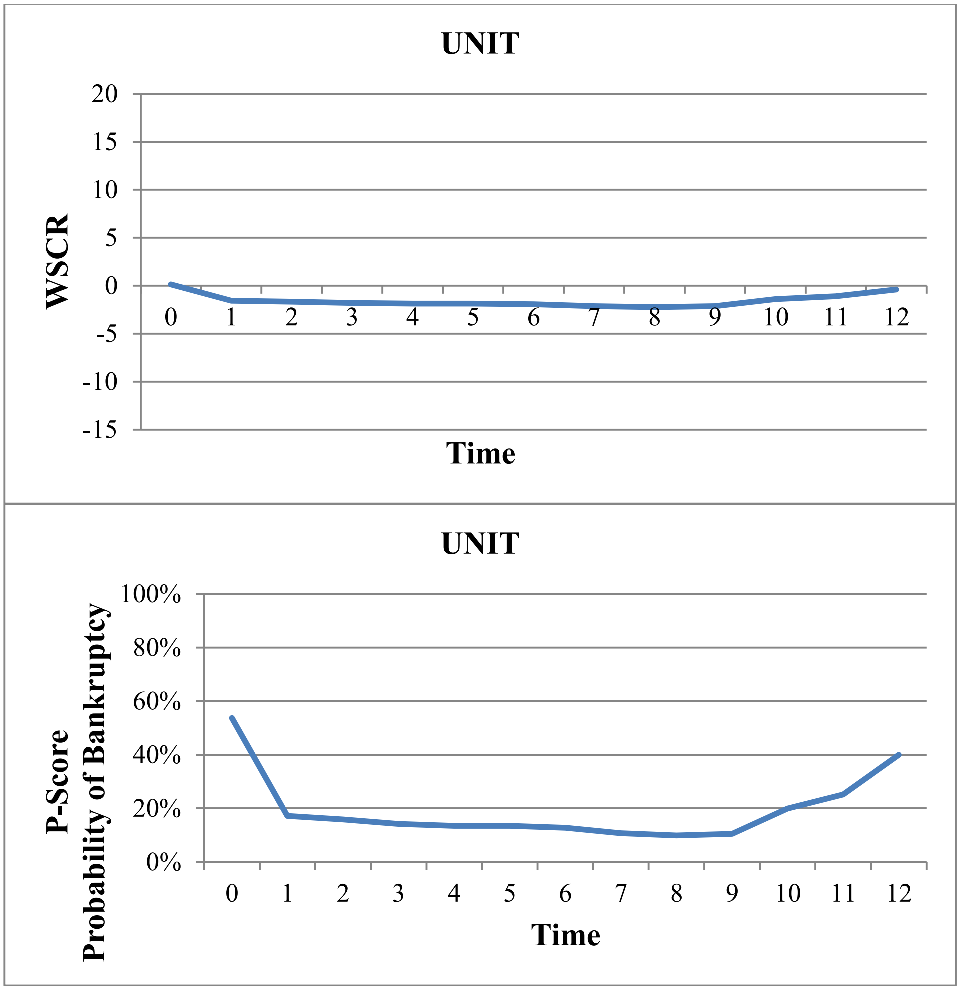


Figure C23. United Airlines W-Score and P-Score.

Table C23. *United Airlines Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	24,856,178	19,461,223	-22%
CATM	0.75	1.03	+37%
DEBT	25,697,044	21,927,048	-15%
DIP	0	1	Yes DIP
AAC	10,688,489	12,280,671	+15%
TIME	0	12	N/A
WSCR	0.15	-0.40	
P-Score	53.71%	40.03%	-13.67 pts.

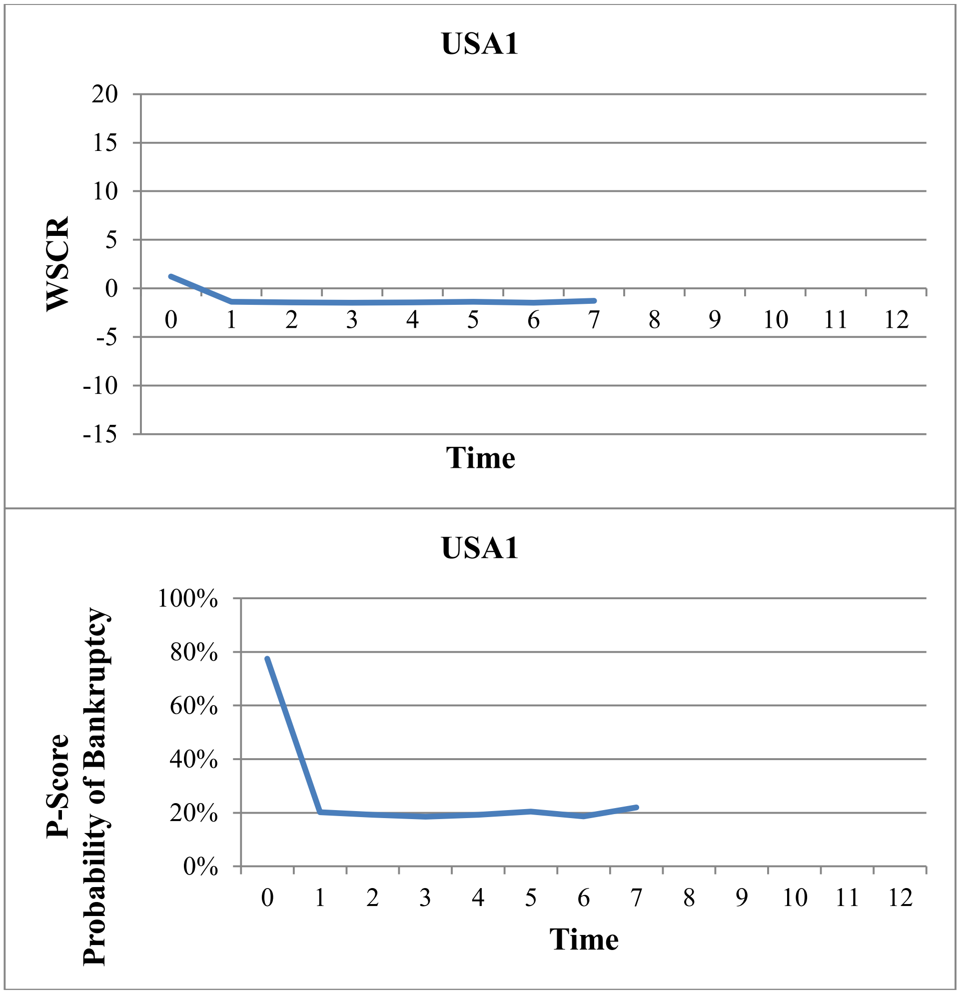


Figure C24. US Airways 1st Bankruptcy W-Score and P-Score.

Table C24. *US Airways 1st Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	9,953,888	8,497,647	-15%
CATM	0.87	0.95	+9%
DEBT	11,130,845	8,710,038	-22%
DIP	0	1	Yes DIP
AAC	7,920,714	7,319,512	-8%
TIME	0	7	N/A
WSCR	1.23	-1.26	
P-Score	77.42%	22.03%	-55.39 pts.

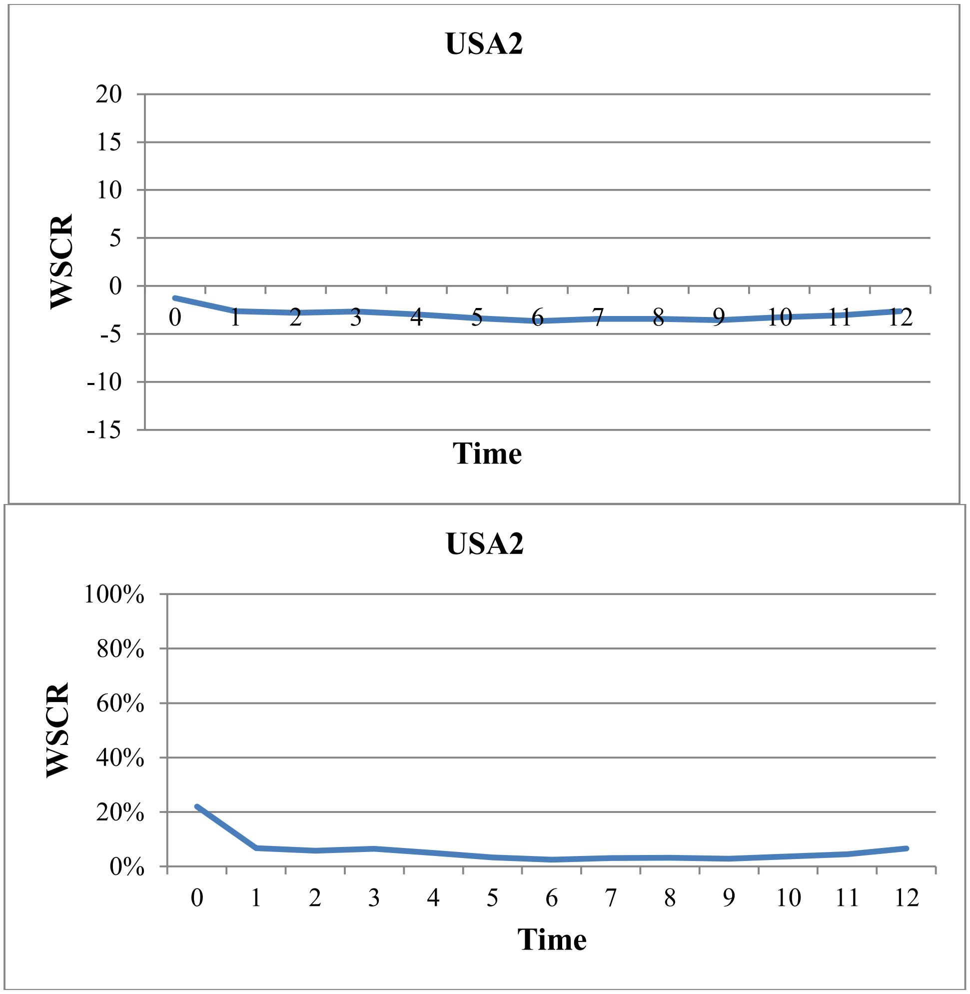


Figure C25. US Airways 2nd Bankruptcy W-Score and P-Score.

Table C25. *US Airways 2nd Bankruptcy Restructuring Strategy.*

Variable	Bankrupt Period	Final Restructuring Period	Restructuring Change
ASTS	8,497,647	7,817,772	-8%
CATM	0.95	1.44	+52%
DEBT	8,710,038	6,809,261	-22%
DIP	0	1	Yes DIP
AAC	7,319,512	7,557,887	+3%
TIME	0	12	N/A
WSCR	-1.26	-2.64	
P-Score	22.03%	6.65%	-15.38 pts.

APPENDIX D

Unconditional Growth Model Tables

Table D1. *Data L1 Unconditional Growth Models.*

		Model B		Model C		Model D	
Intercept		-.999	(.510)	2.131***	(.603)	2.224***	(.607)
	TIME	-.210**	(.064)	-.697***	(.181)	-.989**	(.314)
	$TIME^2$			.044**	(.015)	.115	(.065)
	$TIME^3$					-.004	(.004)
Variance Components							
	Level 1 (Within)	5.244***	(1.539)	5.112***	(1.567)	5.002***	(1.516)
	Level 1 rho	0.774***	(.068)	.765***	(.074)	.761***	(.075)
	Level 2 (Between)	.793	(1.346)	1.313	(1.503)	1.385	(1.482)
	Level 2 rho (ICC)	.131		.204		.217	
Pseudo R^2		.299		.317		.331	
Deviance							
	AIC	835.912		743.637		744.359	
	BIC	852.948		763.306		767.306	

Standard errors are in parentheses. ****p ≤ 0.001* ***p ≤ 0.01* **p ≤ 0.05*

Table D2. *Data L2 Unconditional Growth Models.*

		Model B		Model C		Model D	
Intercept		-1.740***	(.419)	-1.142*	(.483)	2.0168***	(.597)
	TIME	-.169***	(.041)	-.506***	(.141)	-1.234***	(.348)
	$TIME^2$			.029*	(.011)	.182**	(.069)
	$TIME^3$					-.008*	(.004)
Variance Components							
	Level 1 (Within)	4.963***	(.482)	4.822***	(.468)	5.082***	(.516)
	Level 1 rho	.012	(.105)	.009	(.103)	-.069	(.112)
	Level 2 (Between)	2.137**	(.803)	2.169**	(.808)	2.482*	(.958)
	Level 2 rho (ICC)	.301		.310		.328	
Pseudo R^2		.155		.179		.135	
Deviance							
	AIC	1116.185		1112.078		995.479	
	BIC	1133.609		1132.987		1018.975	

Standard errors are in parentheses. ****p ≤ 0.001* ***p ≤ 0.01* **p ≤ 0.05*

Table D3. *Data L4 Unconditional Growth Models.*

		Model B		Model C		Model D	
Intercept		-1.022**	(.412)	-.309	(.508)	2.762***	(.596)
	TIME	-.227***	(.058)	-.660***	(.192)	-1.320**	(.426)
	$TIME^2$			.038*	(.016)	.179*	(.086)
	$TIME^3$					-.008	(.005)
Variance Components							
	Level 1 (Within)	6.873***	(.922)	6.653***	(.870)	6.578***	(.841)
	Level 1 rho	.257*	(.130)	.246	(.127)	.174	(.151)
	Level 2 (Between)	.443	(.553)	.469	(.533)	.643	(.571)
	Level 2 rho (ICC)	.061		.066		.089	
Pseudo R^2		.204		.229		.238	
Deviance							
	AIC	1090.109		1086.616		1025.118	
	BIC	1107.255		1107.192		1048.648	

Standard errors are in parentheses. ****p ≤ 0.001* ***p ≤ 0.01* **p ≤ 0.05*

Table D4. *Data L5 Unconditional Growth Models.*

		Model B		Model C		Model D	
Intercept		-1.373**	(.456)	-.742	(.538)	2.321***	(.653)
	TIME	-.230***	(.048)	-.586**	(.171)	-1.190**	(.411)
	$TIME^2$			.030*	(.014)	.164	(.082)
	$TIME^3$					-.008	(.005)
Variance Components							
	Level 1 (Within)	5.647***	(.731)	5.637***	(.735)	5.956***	(.802)
	Level 1 rho	.161	(.183)	.197	(.159)	.175	(.177)
	Level 2 (Between)	2.148*	(.893)	2.100*	(.891)	2.293*	(1.000)
	Level 2 rho (ICC)	.276		.271		.278	
Pseudo R^2		.275		.276		.235	
Deviance							
	AIC	1103.101		1100.589		1024.286	
	BIC	1120.378		1121.321		1047.848	

Standard errors are in parentheses. ***$p \leq 0.001$ **$p \leq 0.01$ *$p \leq 0.05$

APPENDIX E

Taxonomy of L3 Dataset Models Table

Table E1. *Taxonomy of L3 Dataset Models.*

	Model A		Model B		Model C		Model D	
Intercept	.316		1.552	**	2.202	***	2.610	***
TIME			-.239	***	-.612	**	-1.163	**
TIME*TIME					.032		.156	
TIME*TIME*TIME							-.007	
TCATM								
TCAPX								
TLF								
TDE								
TDIP								
TWC								
TCEO								
TFLET								
TCGDP								
TCJF								
TCNOC								
TCTIR								
TLOGDFTE								
TLOGHAC								
TLOGAAC								
TLOGDEBT								
TLOGASTS								
TLOGNCA								
TLOGMAC								
TAFTE								
TMFTE								
TFTE								
TRATM								
Variance Components								
Level 1 (Within)	8.709	***	7.099	***	6.922	***	6.813	***
Level 1 rho	.374	**	.192		.182		.170	
Level 2 (Between)	1.948		2.318	*	2.379	*	2.387	*
Level 2 rho (ICC)	0.183		.246		.256		.259	
Pseudo R2			0.185		0.205		0.218	
Deviance								
AIC	981.976		971.313		969.896		970.053	
BIC	995.109		987.729		989.595		993.036	

****$p \leq 0.001$ **$p \leq 0.01$ *$p \leq 0.05$*

Table E1. *Taxonomy of L3 Dataset Models (cont.).*

	Model E		Model F		Model G		Model H	
Intercept	1.271	**	1.284	**	1.176		1.265	*
TIME	-.191	**	-.193	**	-.182	*	-.190	**
TIME*TIME								
TIME*TIME*TIME								
TCATM	3.031	***	3.028	***	2.961	***	3.051	***
TCAPX			.605					
TLF					-2.128			
TDE							.004	
TDIP								
TWC								
TCEO								
TFLET								
TCGDP								
TCJF								
TCNOC								
TCTIR								
TLOGDFTE								
TLOGHAC								
TLOGAAC								
TLOGDEBT								
TLOGASTS								
TLOGNCA								
TLOGMAC								
TAFTE								
TMFTE								
TFTE								
TRATM								
Variance Components								
Level 1 (Within)	6.997	***	7.016	***	6.700	***	6.925	***
Level 1 rho	.309	*	.314	*	.253		.299	*
Level 2 (Between)	3.128	*	3.071	*	3.263	*	3.129	*
Level 2 rho (ICC)	.309		.304		.328		.311	
Pseudo R2	0.197		0.194		0.231		0.205	
Deviance								
AIC	960.985		962.531		962.860		962.555	
BIC	980.685		985.513		985.842		985.538	

****$p \leq 0.001$ **$p \leq 0.01$ *$p \leq 0.05$*

Table E1. *Taxonomy of L3 Dataset Models (cont.).*

	Model I		Model J		Model K		Model L	
Intercept	.544		.676		.522		1.243	*
TIME	-.077		-.099		-.071		-.189	**
TIME*TIME								
TIME*TIME*TIME								
TCATM	4.284	***	3.965	***	4.175	***	2.961	***
TCAPX								
TLF								
TDE								
TDIP	-3.229	***	-3.109	***	-3.145	***		
TWC			-.753					
TCEO					-.271			
TFLET							.002	
TCGDP								
TCJF								
TCNOC								
TCTIR								
TLOGDFTE								
TLOGHAC								
TLOGAAC								
TLOGDEBT								
TLOGASTS								
TLOGNCA								
TLOGMAC								
TAFTE								
TMFTE								
TFTE								
TRATM								
Variance Components								
Level 1 (Within)	7.306	***	7.105	***	7.227	***	7.000	***
Level 1 rho	.452	***	.426	***	.445	***	.307	*
Level 2 (Between)	2.724		2.120		2.828		2.920	*
Level 2 rho (ICC)	.272		.230		.281		.294	
Pseudo R2	0.161		0.184		0.170		0.196	
Deviance								
AIC	943.859		943.232		945.739		962.428	
BIC	966.842		969.498		972.004		985.411	

****p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05*

Table E1. *Taxonomy of L3 Dataset Models (cont.).*

	Model M		Model N		Model O		Model P	
Intercept	.875		.758		.835		1.158	*
TIME	-.156	*	-.124		-.126		-.130	
TIME*TIME								
TIME*TIME*TIME								
TCATM	4.112	***	4.223	***	4.029	***	5.096	***
TCAPX								
TLF								
TDE								
TDIP								
TWC								
TCEO								
TFLET								
TCGDP	.377							
TCJF	.075							
TCNOC	-.062							
TCTIR	.000		.000	***	.000	**	.000	***
TLOGDFTE					-1.675			
TLOGHAC							-8.171	
TLOGAAC							6.801	**
TLOGDEBT								
TLOGASTS								
TLOGNCA								
TLOGMAC								
TAFTE								
TMFTE								
TFTE								
TRATM								
Variance Components								
Level 1 (Within)	6.073	***	6.492	***	6.660	***	6.719	***
Level 1 rho	.230		.285	*	.301	*	.368	**
Level 2 (Between)	3.031	*	2.502	*	1.863		1.047	
Level 2 rho (ICC)	.333		.278		.219		.135	
Pseudo R2	0.303		0.255		0.235		0.228	
Deviance								
AIC	952.448		949.627		950.613		938.586	
BIC	985.280		972.610		976.878		968.135	

****p ≤ 0.001 **p ≤ 0.01 *p ≤ 0.05*

Table E1. *Taxonomy of L3 Dataset Models (cont.).*

	Model Q		Model R		Model S		Model T	
Intercept	.833		.950		.884		1.340	*
TIME	-.114		-.123		-.124		-.169	*
TIME*TIME								
TIME*TIME*TIME								
TCATM	4.524	***	4.619	***	4.277	***	3.858	***
TCAPX								
TLF								
TDE								
TDIP								
TWC								
TCEO								
TFLET								
TCGDP								
TCJF								
TCNOC								
TCTIR	.000	***	.000	***	.000	***		
TLOGDFTE								
TLOGHAC								
TLOGAAC	3.505	**	5.141		3.169	*	4.876	***
TLOGDEBT	21.754	***	23.300	***	24.613	***	23.113	***
TLOGASTS	-20.663	***	-19.094	***	-20.157	***	-22.816	***
TLOGNCA								
TLOGMAC			-2.456					
TAFTE								
TMFTE			.102					
TFTE			.000		.000			
TRATM								
Variance Components								
Level 1 (Within)	5.946	***	5.697	***	5.731	***	6.532	***
Level 1 rho	.334	*	.280		.298	*	.402	**
Level 2 (Between)	1.486		1.128		1.349		2.270	
Level 2 rho (ICC)	.200		.165		.191		.258	
Pseudo R2	0.317		0.346		0.342		0.250	
Deviance								
AIC	926.390		928.827		925.516		935.064	
BIC	959.222		971.508		961.631		964.613	

****$p \le 0.001$ **$p \le 0.01$ *$p \le 0.05$*

APPENDIX F

Average Values of Significant Predictors

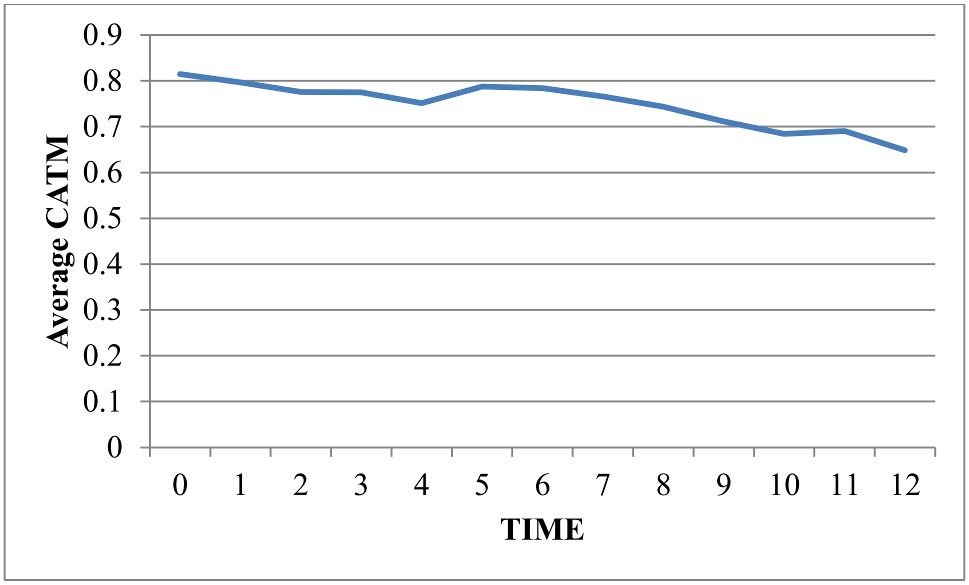


Figure F1. Average CATM.

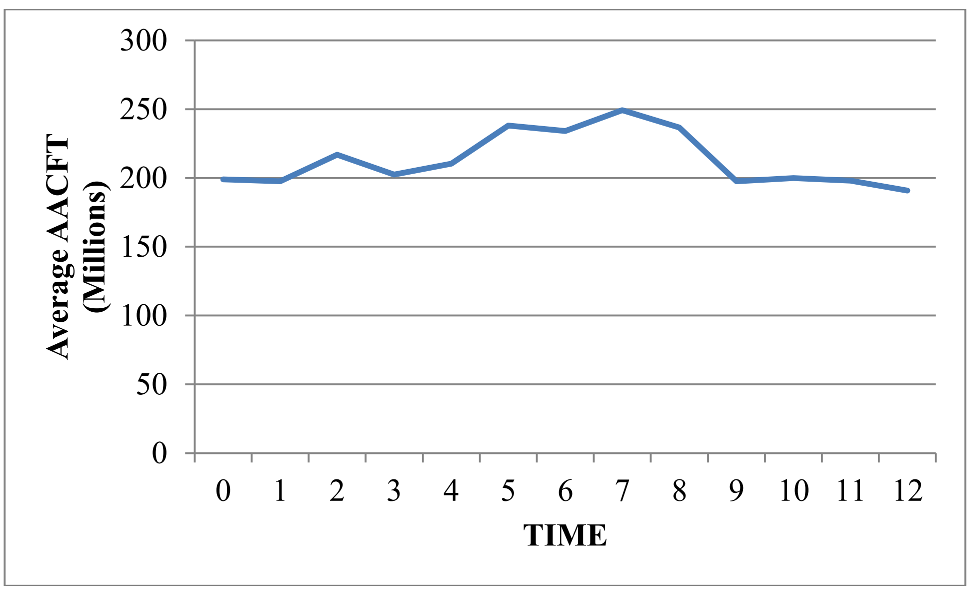


Figure F2. Average AAC.

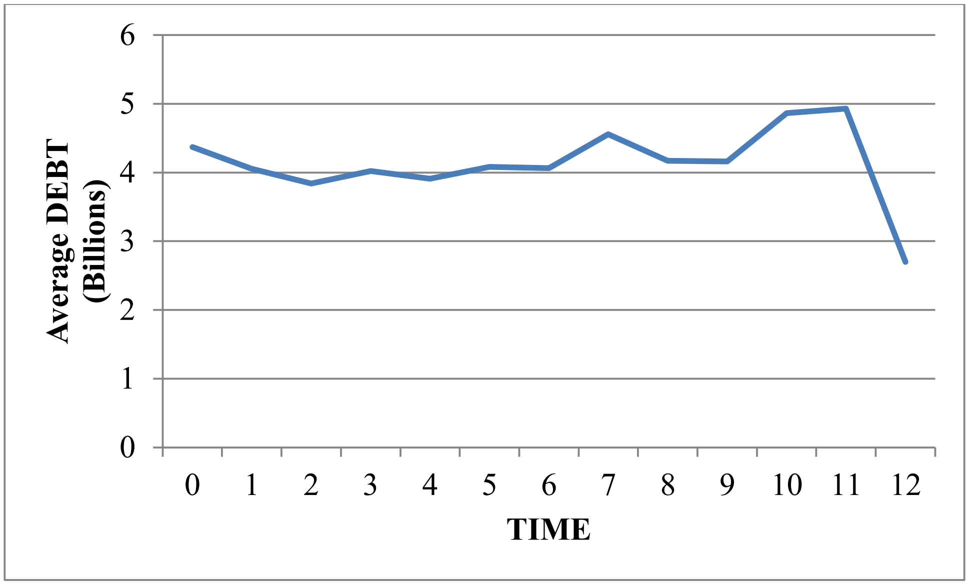


Figure F3. Average DEBT.

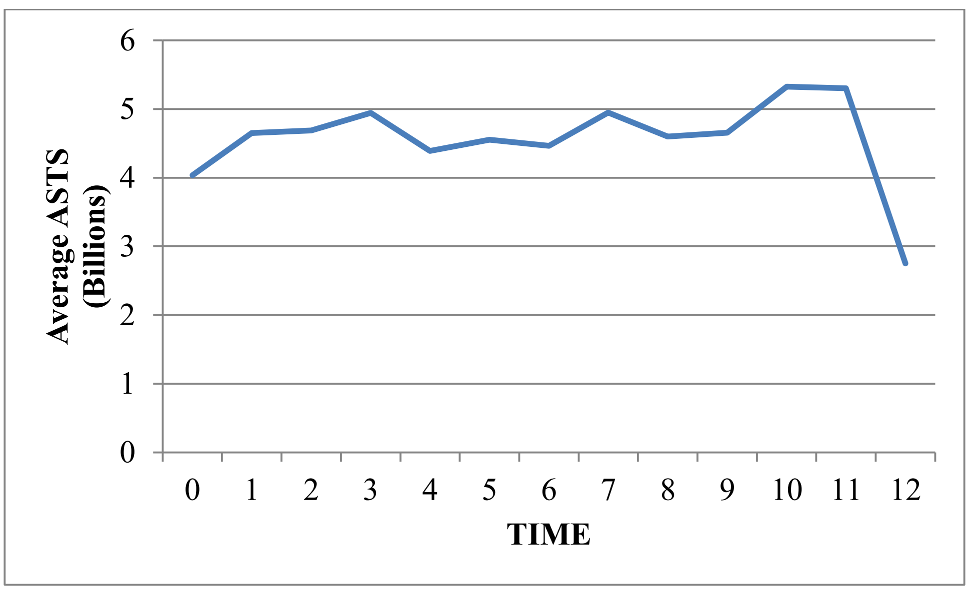


Figure F4. Average ASTS.

APPENDIX G

MLM Residuals

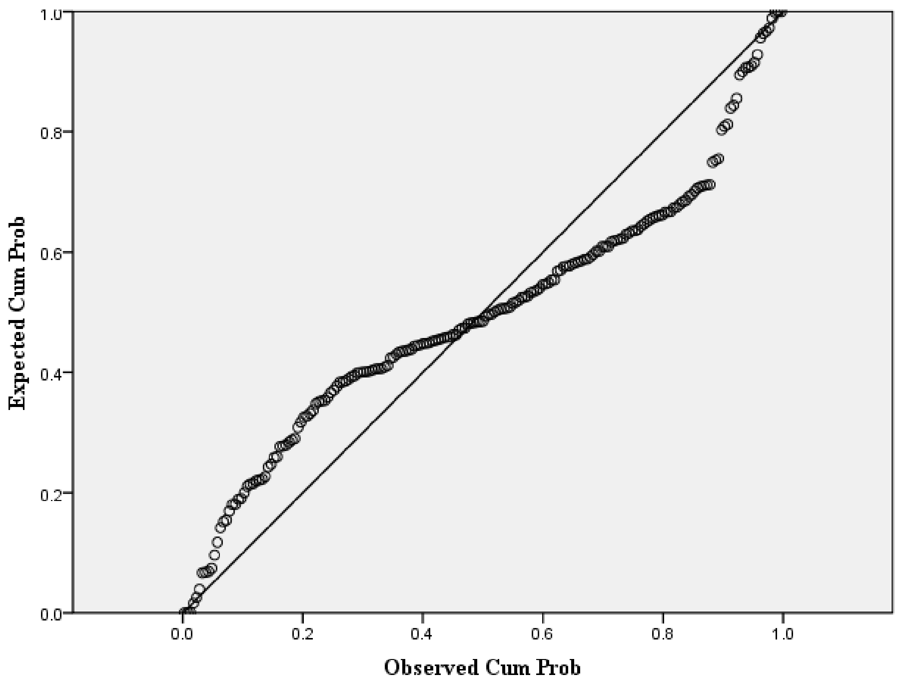


Figure G1. Normal probability plot of residuals.

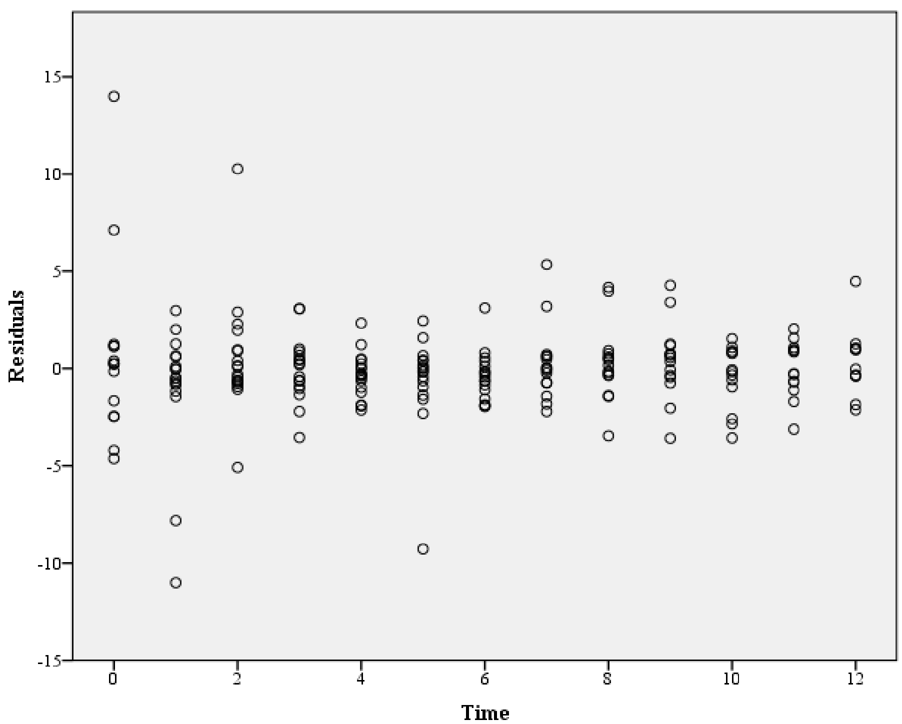
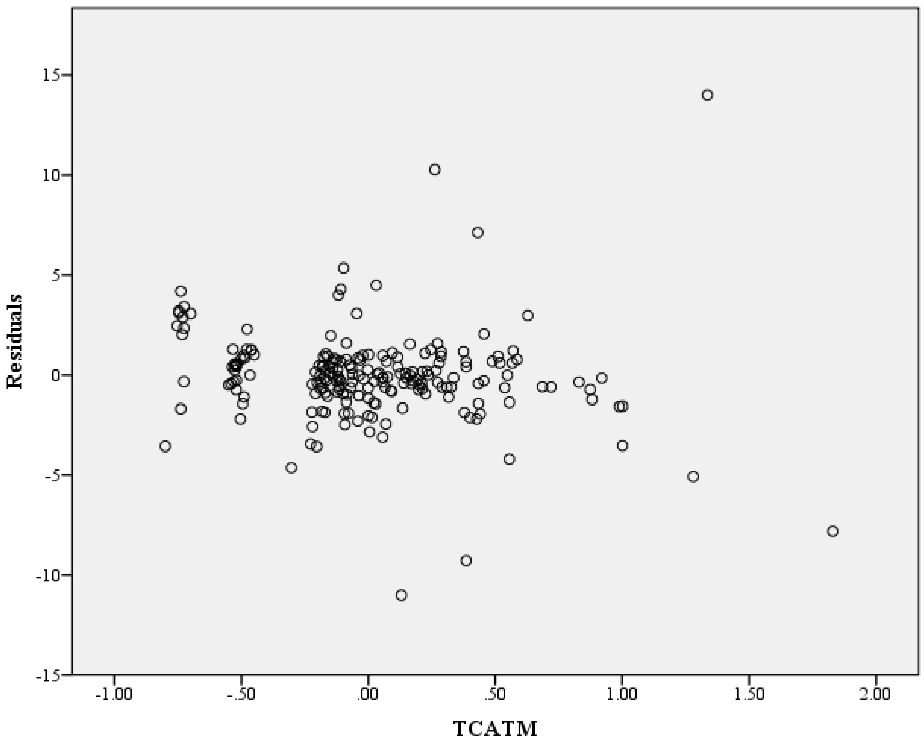


Figure G2. Residuals against predictors.



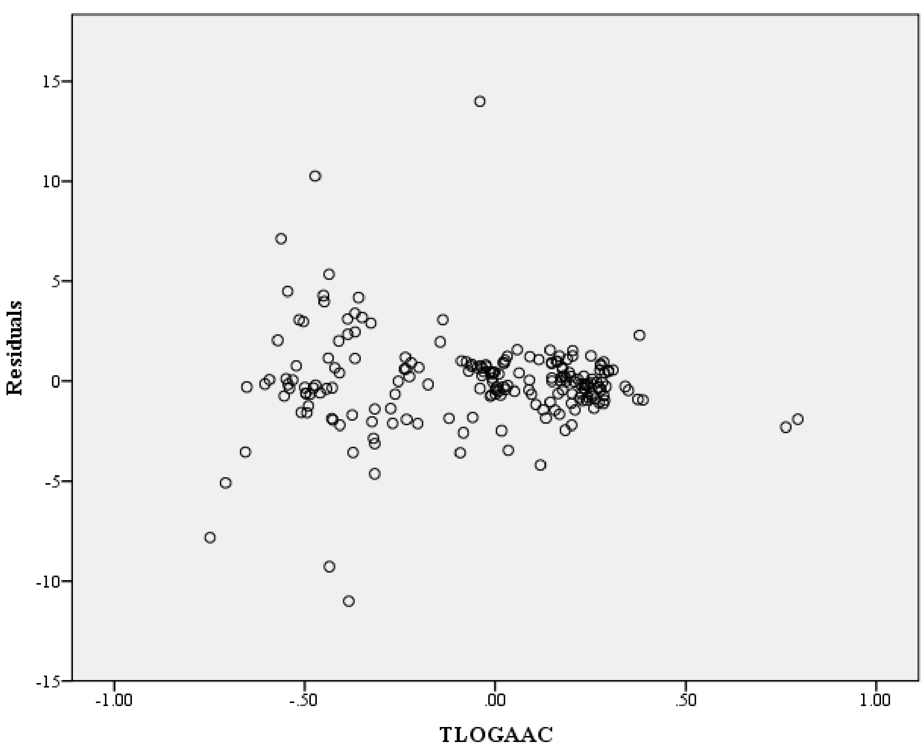
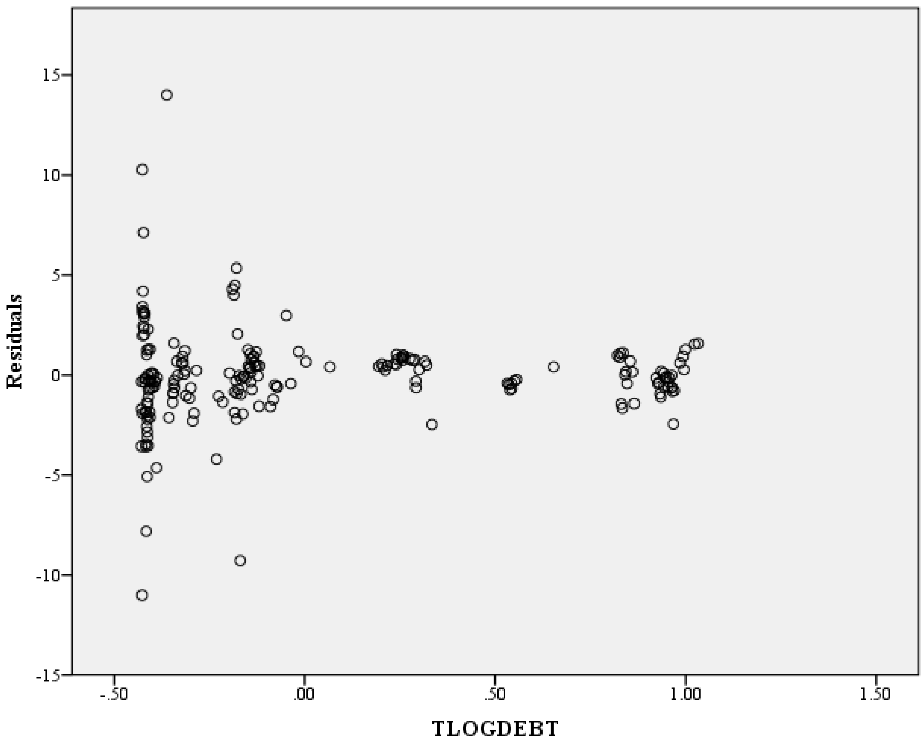


Figure G2. Residuals against predictors (continued).



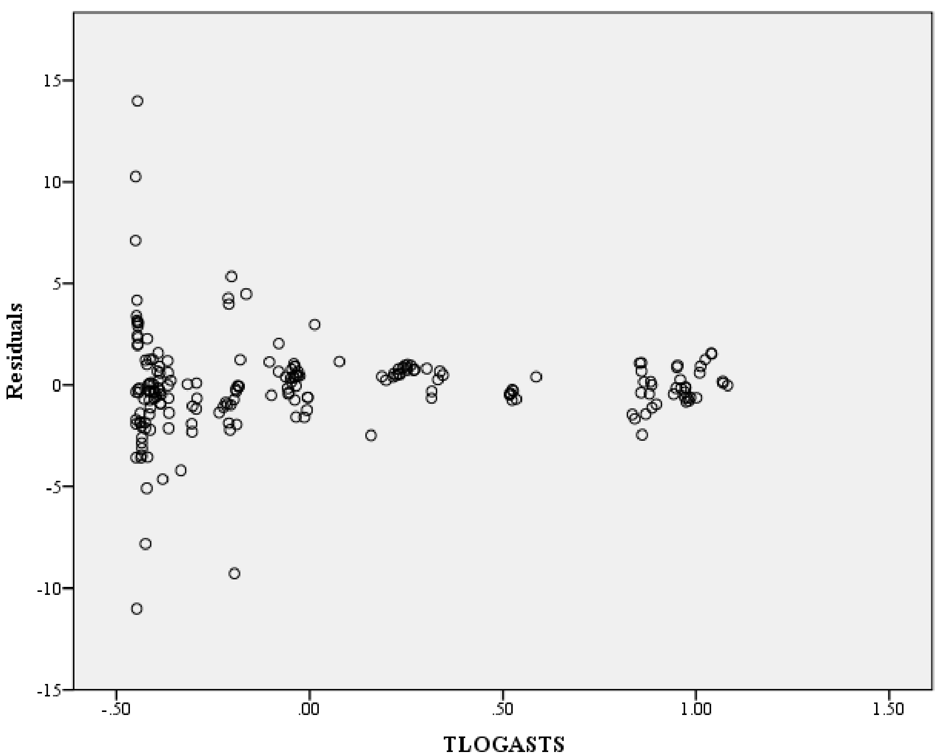


Figure G2. Residuals against predictors (continued).